THE

TIMBERS OF COMMERCE

AND THEIR IDENTIFICATION

BY

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ILLUSTRATED WITH 186 PHOTO-MICROGRAPHS

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Preface

THE material for this work was collected without any idea of publication, and was intended only for my own use. Coming into possession of a business in which very many different kinds of wood were used, and finding great difficulty in distinguishing one from another, I fell back, for lack of any practical experience, upon my knowledge of Botany, and collected a mass of information, not only concerning the woods used in my workshops, but also concerning a constantly increasing range of species.

I have received much valuable help from the late Secretary of the Colonies, The Rt. Hon. Joseph Chamberlain, to whose good will I am indebted for a great number of specimens sent me at his request. Thanks are also due to the Agents-General of South Australia, Western Australia, Queensland, Victoria, New South Wales, Tasmania, New Zealand and Natal; to the Governor of Lagos, and to the Forest Officers of those Colonies, for the liberal way in which they have responded to the request from the Colonial Office. Further I acknowledge most gratefully the assistance I have received from Sir William Thistleton Dyer, Sir Dietrich Brandis, and the late Sir Frederick Abel.

Thanks are also due to the works of Noerdlinger and J. S. Gamble, without which little progress in this study can be made, and in a less degree to those of Wiesner, of Mathieu and Th. Hartig. For information upon the Timbers of Queensland, I am specially indebted to Mr. F. Manson Bailey, who accompanied his magnificent collection of specimens with details of the most extensive and interesting character. For that upon timbers from South Australia I thank Mr. Walter Gill, whose notes form a small treatise in themselves.

It should be stated that some of the Colonial specimens did not arrive in time to be incorporated in the list of species described, but they will be dealt with subsequently, and will form portions of a series of which the present book is the first instalment.

I also desire to thank many personal friends and correspondents, who have assisted me with information and specimens.

In the matter of the Synonymy of the various species, I have been guided by the *Index Kewensis*, and only those synonyms

have been quoted which have been found to be pitfalls in connexion with the subject; hence the list does not pretend to be complete. The alternative popular and vernacular names in foreign languages have not been quoted, when they are merely such as can be found in a dictionary; but when they have a local value only, and may therefore lead the student astray, I have quoted them as far as possible. Exception has been made in the case of the names in the Indian dialects, inasmuch as they are very numerous and are readily accessible in the works of Gamble, Brandis and Watts.

All quotations from writers upon Forestry, etc., are followed by a number corresponding to a list given at the end of the volume. With the exception of those from Noerdlinger, Gamble, Wiesner and Mathieu they are confined to details of the uses, physical qualities, origin of woods, and general information about them.

I have described all woods which I have met with upon the British Market, and those which have been sent me from the Colonies as being useful and abundant, and also a few which, though unknown on this market, commend themselves to me as timbers of good quality which are likely to be heard of in the future.

I have not attempted a Key to the species, as I consider that the knowledge of the structure of wood is not sufficiently advanced to permit of the construction of one which shall be in harmony with the Natural system of classification. I have a Key which often enables me to refer an unknown wood to its Genus, but the Keys that have been published so far are so unsatisfactory, that I have hesitated to add another empirical guide to those already existing. I believe that when it has been decided to what extent two kinds of Medullary rays are present in woods of the Dicotyledonous Trees, a truly scientific Key can be constructed; but this entails a prolonged investigation for which I have not, so far, had leisure.

All the genera mentioned in the descriptive part of the book are represented by photo-micrographs, except where a single illustration serves for more than one genus. The illustrations are types, and are reliable, if allowance be made for variation in size and number of the pores and rays.

The scale of magnification is three times the actual size, and is designed to show the appearance of the transverse section as seen by means of an ordinary hand lens. Wherever there are two or more distinct types of the same genus described, separate illustrations have been provided, and the specific name is then quoted. In every case where possible, the photographs have been arranged with the Medullary rays running in the same direction, the pith side downward. As the illustrations are not

mere process blocks, they will show more detail when examined with a lens.

While sparing no pains to ensure the authenticity of the specimens sent me, and carefully checking them with others from other sources, there still remains a margin for error, therefore the authority for the name has always been quoted. I shall be under a personal obligation to any of my readers who will point out any mistakes. Wherever I have felt any doubt, the name is followed by a note of interrogation, and in such cases I have refrained from quoting the alternative names, except such as have been supplied to me with the specimens.

Finally, I wish to acknowledge the hearty support of my colleague Mr. Arthur Deane, to whose skill in preparing the photomicrographs so much of the value of this book is due, and to my friend Mr. Philip E. Martineau for his kindness in looking over the proofs.

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BRACEBRIDGE STREET, BIRMINGHAM.

Introduction

It would be a difficult task to answer the question, why some plants possess the property of forming wood, while others, nearly related, do not. Why some plants run their course in the brief period of a year, and perish as soon as they have given birth to another generation, while others persist and augment their bulk year by year for centuries. There is much food for reflection here.

Such plants as are endowed with the faculty of secreting a substance which resists decomposition for a long time, and of fortifying their tissues with it, play a very different part in the world's economy to that of their herbaceous relatives, which to-day are, and to-morrow are cast into the oven. They exist long enough to acquire an individual history. This history may not be written in human records, but it has a record of another kind, which may be read in the structure of the tree itself, which, like the Nautilus, adds a chamber to its habitation every year by surrounding itself with a fresh layer of wood.

These layers are perhaps the most familiar feature with which all those who have used timber, or have noted the cut ends of fallen trees, are acquainted, but it occurs to few that the innermost tiny ring enclosing the pith is the section of a stick that was once the seedling tree. The Seedling is a small object, a few inches high at most, and the layers which have been added year by year, were it possible to separate them, would appear as long taper tubes of wood.

In felling Beech, it is not an uncommon occurrence for the young sapling to be drawn out of the tree as it falls, if the centre layers of the butt have not been severed. It will remain standing upon the stump like a peeled wand, and upon it the original knots can be seen.

The annual addition to a tree's growth is, in fact, a conical sheath tapering to a point, and capable of accommodating the plant within to its topmost bud. A seedling is two years old, but not as a child, who is two years old to his innermost parts, for the tree is only one year old as regards its outer portion. The two layers are not merged in one another; the second is merely added. In the case of a full-grown Oak, a century old, only

the pith and first coat of wood bear that age; the next coat is only ninety-nine years old, and the outermost but one. Moreover the topmost branches are quite young, and their innermost parts, scores of feet above the tip of the little seedling from which they have grown, are scores of years younger, even to their pith. Of an ancient hollow tree it may be said that perhaps Robin Hood dined beneath its branches. The general impression is correct, but the fact is not precise; for the tree is no older than its component parts, which, being entirely outer parts, are merely *the growth of the last fifty years or so, as a section of the wood* will prove.

A tree, then, is a living organism whose component parts are of various ages; and upon it arise successive generations of leaves, much as a city rears its people or a coral reef its polyps. The living portion is renewed from time to time, adds something to the tree, and passes away. Time too brings other changes due to other causes than the nourishment afforded by the yearly labour of the leaves, and as year by year a new coat of wood is added, so does an inner layer lose its vitality and become inert, and so does a still deeper layer undergo still further changes which produce the heart-wood. This heart-wood will not be found in all trees, for some exhibit no distinction in this respect and are the so-called Sap-wood trees, though even here changes take place which bring the timber to maturity. In a living 'Heart-wood tree,' there can be distinguished the pith, heart-wood, sap-wood, the active living layer, or Cambium, the bast and the bark. The Cambium layer is a very delicate sheath of thin tissue which is the source of the new wood, and which, by the multiplication of its elements (cells), adds layer upon layer to the wood already formed. On its outer side it adds to the bast but in a much smaller degree.

The bark, enclosing all in an impervious clothing, serves the purpose of checking the evaporation which would endanger the existence of the delicate Cambium layer within.

The young wood lying nearest the outside partakes of the nature of the Cambium at first but rapidly becomes altered. The walls of its cells, originally thin, become thickened and woody, but for some time they retain their capacity for absorbing water, and form the channel by which the water from the roots ascends to the leaves. The further from the bark, the less is this capacity possessed by the wood, and though it is rarely if ever quite lost, yet the difference in the rate of absorption of water by the sap-wood and heart-wood is considerable, as can be seen by moistening the cut surface of a piece of wood where both are present. While the water sinks rapidly into the sap-wood it sensibly lingers on the surface of the riper part.

INTRODUCTION

The vital processes which constitute the physiology of plant life are beyond the scope of this work: it deals solely with their product—the wood, which while living is a *tree*, but being dead is *timber*. The structure which has been described is evident in whatever form the timber may be found, but, as the conversion of the log into useful pieces entails the division of the tree in many different ways, it requires a little more attention to follow it through its changes of appearance.

As, then, a tree consists of concentric CONES of wood, if it is sawn into planks the outermost plank will be a curved flitch of bark, with some sap-wood on its inner side. The next plank will have sap-wood on each edge, and a strip of heart-wood down the middle, which strip will increase in width, plank by plank, until the centre of the tree is reached. Lines which mark off cone from cone (that is, annual ring from annual ring), may seem parallel at the lower end, but will join as loops at the upper. It is only when the section approaches the horizontal that the annual rings approach the circular, so that oblique cuts show an almost infinite variety of form. In fact, two planks are never alike in every detail of figure except by accident. An interesting experiment is to slice a hyacinth or other "tunicated" bulb in various directions to see how great a variety of forms is produced by the section of its many coats, and there is nothing which can afford a better interpretation of the structure of the annual rings of a tree.

I have referred to the Autumn and Spring zones as though all woods possessed them, and it will be found that the same expressions are generally employed in the literature of Forestry. They are, of course, only appropriate in connexion with those species which grow in temperate climates, as the period of greatest vigour in tropical trees is not necessarily that of Spring, while it is possible that there is no resting period like our Winter. Judging from the structure this state of things is by no means unusual, and from British Guiana come a number of species, conspicuous amongst which is the Greenheart (Fig. 99), now so largely used for piles and wharf-timbers, which display no indication whatever of a regular alternation of seasons.

In most works on Forestry much stress is laid upon the width of the annual rings, and careful measurements have been made to ascertain the average width, in order to supply data for estimating the probable annual production of wood. As this is the measure of profit the importance of these figures cannot be overrated, but inasmuch as they have little, if any, value for the purpose of identification, I have only mentioned them by the way. The annual increase of the Rock Elm, which, as its name implies, grows amidst barren rocks, is naturally

slow, perhaps as little as $\frac{1}{16}$ of an inch per annum, whilst its near relative the White Elm is enabled to put on as much as half an inch in the same time, and seldom less than $\frac{1}{8}$ inch. If the White Elm were planted upon rocky ground it would probably produce timber almost identical with that of the Rock Elm.

One or two details concerning the ring are useful, viz., the contour, whether regular, waved (Fig. 122), toothed (Fig. 57), etc., and the boundary, which may be formed by a fine line of dense Autumn wood (Fig. 34), a line of contrast between the lax wood of Spring following upon the dense wood of Autumn (most Conifers, Deal, etc.) (Fig. 212), or a similar contrast formed by a pore-ring in the Spring wood (Elm, Ash, Oak), or the boundary may fail as already shown in the case of the Greenheart. It is vague in the Oriental Plane-tree (Fig. 115), and provides a ready means of distinguishing that wood from the wood of the Western Plane-tree (Fig. 114). This latter wood has particularly clearly defined, dense, narrow boundaries to the rings.

It must be carefully borne in mind, however, that the boundaries of the rings of woods like the Oriental Plane-tree may be very clear at times, and can vary much in the same piece of wood. Nördlinger uses this feature, the definiteness or indefiniteness of the ring boundary, as one of the chief divisions in his key to the species in his wonderful book of sections. This is a fatal blemish to that otherwise monumental work, and makes his key almost impossible to use. Care must always be taken to avoid confusing bands of pigment with the annual rings. In the Rosewoods the black zones are usually concentric, and only on close examination are they found to be out of harmony with the structure. A good illustration can be seen in Olive wood (Fig. 86), so commonly made up in Birmingham into mementoes of the Holy Land, in which wood the black zones are always eccentric to a great degree. A curious and beautiful wood from British Guiana, called Hoobooballi (Fig. 55), exhibits these dark zones in a very unusual wavy form, the crest of the waves of one circle meeting the hollows of the waves of the next, so that the lines approach and recede from each other. The Gimlet wood, from Western Australia (Eucalyptus salubris), shows a somewhat similar arrangement, but here the true annual rings behave in the same manner. The whole stem of this tree is on the twist, and being three-lobed, or buttressed as it were, gives rise to its appropriate popular name.

The cut which passes through the centre of the tree in the line of the pith presents a complete change of appearance, for a feature which is not so conspicuous in the other sections is

brought into prominence. This is the Silver-grain or "felt," which forms the beautiful flakes so much esteemed in Oak timber, and which is composed of fragments of tissue called "medullary rays." These, when seen on the end of a plank or on the stump of a tree, resemble the radial strands of a spider's web (See *Frontispiece*), a resemblance which is heightened when the annual rings are prominent enough to simulate the cross-bars of the web. As the rays proceed from the centre outwards it is only in those cuts which follow a radial direction—that is, in "quartered" timber—that they appear at their best, but they may be seen on the sides of boards, becoming bolder and bolder the nearer the plank is to the heart, until upon the centre plank they occupy so large a proportion of the surface as to make it seem a different kind of wood to the neighbouring planks.

It must not be supposed that all woods share this feature in so great a degree as the Oak; on the contrary this valuable figure is obscure in most species and frequently needs careful search to find it.

There is, however, no wood in which it may not be found. There are some kinds which do not show the annual rings, others which lack other features present in the Oak, such as the pores or the soft tissue; but none of the Conifers, or of the Broad-leaved trees, can be found without these rays or silver-grain (see Plate xxiii.).

The pores just mentioned are the little grooves seen upon the surface of cut planks which give to them the appearance known as "coarseness of grain." They are little tubes technically called "vessels" whose openings can be seen at the end of a plank (transverse or horizontal section) closely arranged in the annual ring in various ways. The pores become smaller and smaller as they approach the Autumn or outer boundary, until they seem to disappear from very tenuity and, both "plankwise" and "across-grain," require a lens to follow them. In the Oak (*see Frontispiece*), which is the easiest and best example, these smaller pores are arranged in little tree-like patches, imbedded in a mass of light-coloured soft-tissue. This is composed of short, thin-walled cells unlike the mass or ground tissue of the wood, which is chiefly built up of long spindle-shaped fibres with thick, woody walls, imparting the qualities of hardness and tenacity to the timber. The soft-tissue, on the other hand, lacks these properties, but has a peculiar significance, inasmuch as it is frequently the character which declares to which division or group the wood belongs. The conspicuous "pore-ring," the character which most strikes the eye in many woods, has but a trifling value in this respect, for there are

many species of Oak in which the pore-ring fails altogether, and even the annual ring is difficult to make out, while the little strings of branching pores, along with their attendant soft-tissue, are always present.

It is a singular fact that as the tree ages the size of its cells and pores increases ring by ring and year by year, so that upon the surface of a plank "cut on the quarter," i.e. in the plane of the radius, very narrow pores lie near the pith and large ones near the bark, with all intermediate sizes between. Thus a plank may be "fine grained" in one part and "coarse grained" in another, whereas if the plank is cut from the outside of the tree (tangentially), the grain or size of the pores and cells may be nearly uniform throughout. This increase in the size of the pores and cells ceases at a certain age in each species (40). The Oak and the Hickory exhibit this phenomenon in a striking degree. (Compare Figs. 117, 125, 151 and 152.) The tree at the period at which this increase stops may be said to be in its prime, for the wood then produced possesses greater strength, weight, tenacity, etc., than that produced either before or after (40). From a timber merchant's point of view this question of growth is an important one, and it must be borne in mind that it is *wood* and not *cavities* that the user of timber wants; the greater the proportion of pores, the less wood and the less weight and strength the timber will possess.

A slow grown piece of Oak is a mere succession of pore-rings, i.e. of little tubes, whereas well and fast grown Oak has a large proportion of hard woody ground-tissue outside the pore-ring, in which the rapidly diminishing pores form a comparatively restricted area. There is no strength in holes, and the fewer there are the better. In Coniferous wood such as Deal, which is free from true pores, the slowly-grown wood, unlike the faster-grown, is small celled and dense. It is merely a question of solid matter of which the weight supplies a good indication.

The counting of the rings is not an infallible indication of age even when they are counted at the butt of the tree. There are causes which disturb the even succession, such as the destruction of the leaves by insects during the growing period, in which case the ring is prematurely closed; much after the manner of the usual Autumn cessation of growth. If, as is sometimes the case (the Oak again is an excellent example), the tree has power to put forth fresh leaves, the growth recommences with a pore-ring, or other lax tissue, as in the normal spring zone. Thus two rings arise instead of one for the same year. It has been suggested that in tropical climates two independent seasons of growth may cause two fresh rings every year, but the idea needs experimental verification, though not of itself improbable. For the most part

the annual rings of tropical trees are difficult to deal with; they are often entirely absent and no rhythm of structure indicates the periods of growth, and in several instances, to be mentioned later, the pores and other elements steadily increase in size, indefinitely, from the pith outwards to the bark.

The Heart-wood and Sap-wood so familiar in the Oak, are by no means universal. Familiar examples of trees without heart-wood are the Beech, Sycamore and Birch. American birch, by the way, has both sap-wood and heart-wood. Sometimes the two kinds of wood are distinct from each other, as in the Ebony, where the sap is white and the heart black, while in others the former seems to acquire the characteristic colour gradually, and melts insensibly into the darker heart-wood.

The pith frequently exercises some influence upon the contour of the rings. The common Oaks (Fig. 51) have a five-lobed pith, and the young layers of wood follow it closely, and it is not till the tree has arrived at a considerable age that the influence of the pith is lost. The Hornbeam (Fig. 122) retains it for an even longer period, and instead of the rings becoming gradually more regular the lobed form seems to become more pronounced so that the bark, though externally smooth and cylindrical, is internally thickened where the hollows of the waves occur, and is very thin above their crests.

The pith of all true Boxwoods is lozenge-shaped in section, or like a narrow bar with a circular swelling in the middle. (Fig. 178.) The West Indian Boxwood, on the contrary, has a round pith that is nearly always cracked, so that this feature is often sufficient to distinguish the true from the false Boxwood. All species of Walnut have a most remarkable pith consisting of a series of diaphragms dividing the tubular cavity into a number of small chambers, as may easily be seen by cutting a twig from a Walnut tree. Workmen are familiar with this rather unwelcome peculiarity, as it forms a serious defect in the centre plank of every log. Although the original pith of the tree-trunk may not often be accessible, yet small knots here and there exhibit this feature.

The bark has always been considered a most useful aid in identifying woods, and in some cases is the only decisive detail, as in the two species of Eucalyptus, the Morrell and the Salmon Gums of Western Australia. The former has a roughish fissured bark, while the latter has a bark without a fissure or wrinkle, and a cuticle or outside skin with a peculiar greasy lustre, that suggests "at long range" a salmon's scaly skin. Apart from this feature a microscope fails to find a single essential point of difference.

The terms used to describe the bark, such as corky, wrinkled,

leathery, fibrous, etc., explain themselves; but as the small breathing holes which perforate it are not familiar objects, the botanical term "Lenticels" must be employed. These lenticels are perhaps most conspicuous upon the bark of the Silver Birch, where they form the centres of long horizontal stripes, that become longer as the tree increases in girth. Each species of tree has its peculiar kind of lenticel, but as a rule they cannot be readily found upon old trees where the bark is much fissured and rugged: they must be sought for at the bottoms of the fissures and upon the fragments of the original cuticle that often persists upon the tops of the corky ridges. The bark at the base or butt of the tree frequently differs from that which clothes the upper portion. In the Birch again we have an example, for its bark, though smooth and laminated like paper above, is usually rough, fissured, and corky at the foot. If a section of the lower part be taken, a mass of hard, rod-like, light-coloured bodies will be seen imbedded. This may serve as a type of that which is to be observed in other species, but in addition it must be noted whether the bark is in two distinct layers (Raspberry-jam Tree) (Acacia acuminata), and also whether the ends of the rays leave their impression upon the inside of the bark (Beech, Oak) or, again, if they are apparently continued some distance into the bark with the woody part of the ray connected to the distal portion by a "tongue-and-groove" (Oaks, Casuarinas). (Fig. 171.)

If the bark be deciduous, as in the familiar Plane or Button-ball tree of the London squares, it will naturally be but seldom found upon a log that has travelled, nor will it be otherwise if it be not firmly adherent. Some barks shrink more rapidly in a vertical direction than the cylinder of wood within, and thus detach themselves (Purpleheart, Copaifera), while others are firmly attached to the wood and separated with difficulty (Boxwood).

The outer surface of the naked log corresponds with the inner surface of the bark, unless there is a considerable thickness of bast between them. In any case the markings on this outer surface may not only serve as a means of identification, but also to show in what manner the grain or fibre of the tree runs, whether spirally, as in the Lignum vitæ, or sinuously, as in the Australian Gum trees—both also important items from a technical point of view. (See Figs. 163–167.)

Beneath the bark of trees many insects find food and shelter, chiefly the larvæ of beetles and moths. Some eat their way into the solid wood to form cylindrical holes or galleries such as may occasionally be seen even in Ebony and the Australian Ironbark. Others confine themselves to galleries made in the newly-formed wood immediately beneath the bark, and travel in a peripheral direction only. As the wood removed by these parasites is still in

the living condition, the gaps made in the tissue are promptly filled up with a brownish mass of cells almost as soon as they are made. (Figs. 124 and 186.) Whether these cells be Thyloses (see p. xx), or Callus, I am not in a position to decide. Nördlinger holds them to be the former, but it seems difficult to believe that the large spaces sometimes found can be filled up in this way. Why, too, is the colour always changed to brown? This needs further investigation. The resulting brown flecks are as characteristic of the species as any other feature, because the grub is faithful to its special tree and prefers it to all others, therefore as a series of years can scarcely pass without the presence of the grub, no log of wood of a susceptible species of tree will be found without these traces. A section of English Birch will often display these 'flecks' in hundreds. A peculiarity of the flecks is their property of giving rise to new rays in abundance, sometimes amounting to a dense brush-like tail (Mountain Ash, Maple). Similarly the "Bird's-eye figure" of Maple arises from the attacks of an insect. In this case the repair of the injury causes a little dimple-like depression in the outside of the wood, which is faithfully overlaid by every subsequent annual ring. The dimple is therefore a miniature hollow, containing a number of strata, and if the wood be sawn tangentially, the top of the hollow is removed and the edges of the successive strata exposed in concentric circles, resembling the contours on a geological map where a bend in the strata has been denuded. (Fig. 170.) The tails or brushes of rays may be seen in either radial or transverse sections, thus indicating their origin, even if the seat of injury be not evident in the specimen examined.

Having dealt with the general structure of wood as it may be seen with the naked eye, it is necessary to consider the form in which the elements are arranged. It is not the intention here to go into microscopical details concerning the cells themselves. That portion of the subject has already been dealt with in many excellent text-books, and as the grouping or arrangement of the elements of the wood, rather than the cells, pores, etc., themselves is the material upon which this work is based, it is unnecessary to enter upon details which are so readily accessible elsewhere. Moreover, to study the histology of wood, it is necessary to adopt laborious methods, while here it is desirable to employ simple means, and to do as much work as possible with the naked eye or the pocket lens. The microscope is a valuable and even indispensable accessory, but even here low powers of magnification meet all needs, and more is lost than gained by restricting the field of vision: no lens should be used which will not bring the whole breadth of an annual ring into view at the same time.

It is enough to say that every part of a piece of wood consists originally of cells, or closed cavities, which in the case of the pores or vessels become modified into tubes : even in these the remains of the original partitions are to be seen. These cells are of various forms: round, polygonal, spindle-shaped, rectangular, etc., etc., and are usually characteristic of the tissue they assist in forming, as will be seen when referring to each special class. The chief feature of the wood of all Coniferous and Broad-leaved trees is the system of rays, not only because rays are never absent, but because they are a most important factor in the classification of wood.

In a piece of Beech (Fig. 128), on a transverse section, these rays arise in a fine point, increase in width and again decrease until they taper away again to vanishing point. By observing the Tangential section, as is easily done by removing the bark, it is seen that, though much shorter, they preserve the same form, i.e. that of a spindle or tip-cat, tapering at both ends. Laterally, in a radial section, it is almost impossible to make out their shape, for they never remain uninjured; still, from their form on the two sections already described, their shape may be deduced. This I believe to be a double-edged, double-ended blade ; something resembling the outline of a fish, such as the dace or minnow, but of course very much longer in proportion to its depth. It has been stated by A. Mathieu (37) that the rays do not taper to a point in a transverse section, but that they curve downwards, hence the cut traversing the narrow upper edge of the ray causes the appearance of tapering to a point. Out of many thousands of radial sections of some 1,300 different species I have never seen any indication of this bending of the rays; on the contrary they are always remarkably straight, as are their component cells also. It must on the other hand be confessed that neither has any indication of the tapering to a point in a radial section been observed; the difficulty of isolating a ray has so far stood in the way of a practical proof. (See Figs. 168, 169.)

This discussion may seem discursive, but there is this to be said, that the form of the rays is an exceedingly important factor in the composition of the "figure" of timber, and a clear idea upon this point will often enable one to deduce the " figure " from a small fragment of wood taken in any section, such as a chip from the corner of a log.

The greater number of species of trees have merely one kind of ray, but in the Oaks (Figs. 121 to 129) there are two kinds, large and small. The large rays are usually very broad and deep in a tangential section, and are seen to be composed

of an irregular mass of small cells, while the smaller rays, on the contrary, possess much larger cells, usually in a single row one above another, and are difficult to see in any section. Furthermore, the large rays are frequently compound, or composed of many rows of cells, and run direct from point to point, whereas the small rays appear to avoid all the large pores which lie in their course, or to be pushed aside by them. This latter character is found with great frequency in woods having rays of uniform size, whether they are broad and firm, or merely like fine threads meandering amongst the pores (Fig. 143). In point of size the rays may vary considerably from the broad ones in the classes mentioned, through all possible grades to the excessively fine ones of the Horse-chestnut (Fig. 32). They vary greatly in the same piece of wood, or in different individuals of the same species, or in the wood of allied species: but like all the other characteristics, there is a limit, a maximum and a minimum, fixed for each kind. It often happens that the limit of length is difficult to fix unless a very large piece of wood is available, as it is not unusual for a ray to extend from ring to ring through thirty years' growth or more before commencing to taper. The very large rays often seem to dilate outwards indefinitely (Fig. 17), and in some cases may do so, while others run their course in the space of two of three annual rings only (Fig. 73). The Beech is a good example to study, and the mere examination of the wood of a plane or other carpenter's tool will generally suffice to demonstrate this point. Whenever a piece of well-smoothed wood is met with, it is good practice to examine it in whatever form it may be made up. Something is sure to be learnt from it, providing care be taken to find the transverse section where the annual rings "crop out" and supply the key to the other sections.

As the circumference of the annual rings enlarges, the original rays become wider and wider apart, and new rays arise from time to time in sufficient numbers to keep the proportion of the rays to the mass of the wood fairly uniform. These new rays obviously have nothing to do with the pith, and being indistinguishable from the older ones cannot be called in any sense "Medullary," and even those of the first year's wood have no intimate connection with the pith, which may perish entirely without any apparent disturbance of the function of the rays. I therefore use the word "rays" without the usual qualifying adjective. The term "pore" is another which needs justification as the word "vessel" is considered more correct. It may be conceded that it is so, yet it is less convenient and, to those who approach this study without preliminary training in Botany, it is less familiar and appropriate. The simple term "pore" requires

no explanation; it is currently employed by those who handle woods, who naturally speak of a "porous" and not of a "vascular" wood. The analogy on the one hand is to the blood-vessels of the body, on the other to the "pores" of the skin, between which there is little to choose, while to the lay mind the word "vessel" calls up images of many familiar objects which present no analogy whatever to the pores of the wood. May the critics pardon an excusable bias in favour of simple language.

The Pores are narrow tubes running vertically up the stem, and having the function of conveying air and fluids for the service of the plant. It is not known how long these minute tubes may be. I have blown bubbles through an apparently solid stick of Norwegian Birch four feet long, and I have pumped air through the whole length of a pole 11¾ feet long, and further I have pumped water in a continuous stream through a piece of American Birch ten inches long by one inch diameter, from which it ran as fast as it would have done from an open tube of ⅛ inch bore. I see no reason why these limits should not be exceeded with proper apparatus, especially if straight, well grown, uninjured poles of Oak are used.

In all but the very young wood the pores contain either air or the accumulations of by-products of the vital activity of the leaves, chiefly gums and resins, and sometimes a curious tissue like a mass of bubbles, which arises as follows. The walls of the cells and pores, when examined under a high power of magnification, are seen to be "pitted" all over with spots where the tissue is extremely thin. In fact these "pits" are holes closed by an excessively thin membrane, and are usually opposite to similar perforations in the next adjoining cells or pores. If one of the latter becomes empty, this membrane is forced out into the cavity accompanied by some of the living contents, which subsequently divide and multiply after the manner of the Cambium (already spoken of as lying under the bark). There is, however, this difference, that instead of wood-cells, they give rise to this bubble-like transparent mass of tissue called "Thyloses." This will frequently be met with in pores of large diameter where the wood has not the property of filling its pores with gum or resin. Another kind of filling occurs in certain tropical woods, especially Teak, and appears to be of a mineral nature. According to Sir F. Abel it is "Apatite" and may be seen as white lines on the surface of Teak planks. It is very hard and rapidly dulls the edge of cutting tools. In a certain species of wood from British Guiana (Suradanni) I have seen accumulations of this substance accompanying decomposition, practically replacing the inner rings of the

centre of the tree and forming masses of stone weighing many ounces.

In the course of the building up of the wood by the Cambium, the pores are produced at intervals amongst the wood-cells and arise not in a haphazard fashion but in rhythmic succession. At times they are produced in such abundance and so closely crowded that this rhythm cannot be traced, but in all cases where the pores are separated by spaces occupied by wood-cells a definite arrangement of the pores exists. It may seem to be labouring the point to speak of " rhythm " where the pores on a transverse section seem " peppered " all over the annual ring, yet the more specimens one examines the more one feels convinced that order reigns even in apparent chaos. In a great number of cases a definite order can be seen. The pores may be arranged in undulating festoons, as in the Common Elm (Fig. 107), or in radial, tree-like groups, as in most of the Oak tribe (Fig. 152), the Bullet-woods from South America and their allies (Sapotaceae) (Fig. 83), or in radial rows of single pores (Holly) (Fig. 27), or in flame-shaped groups (Buckthorn), or, as most frequently in our European woods, in a ring of pores in the early spring zone of the annual ring. For the most part, as already stated, the pores are smaller if not less numerous in the Summer and Autumn zones, the latter being frequently very poorly provided with them. If it should happen that a wood has more pores in the Autumn than in the Spring zone, that wood is surely Coniferous (Figs. 137, 138), but these pores will be found to be of quite different nature to those just described, in fact they are glands containing resin and are more properly called " Resin-canals or ducts." Their presence is an indication that the species belongs to one of a limited number of genera allied to the Pine-trees. Many kinds of wood have pores in small closed groups which convey the impression that a " mother-pore " has become subdivided into a number of " daughter-pores," not merely pressed or crowded together but clearly indicating a common origin. Usually they are in short radial rows, and sometimes there are as many as ten gradually tapering off from the innermost and largest to the very much smaller, outer pores ; or the largest may be in the middle of the group, or the group may be a cluster or nest of pores. If the wood be cut in a radial direction, a row of closely arranged pores may be exposed at the same moment, so that the wood will appear very " coarse-grained." On the other hand, if the cut be tangential, the radial row of pores will be cut at right angles, and only one of the series will appear on the surface.

Similar difference of appearance is caused by oval pores

which are always radially elongated, so that a radial section makes them appear as broad grooves, whereas a tangential cut will show but half their width. Confusion can easily arise in practice from this cause, and no small demand is made upon the imagination to reconcile the differences shown by an oval-pored wood cut on the quarter (radial section), with its abundant coarse grooves and showy "silver-grain," and another piece of the same wood cut "plank-wise" (tangential section) on which but few narrow pores and no "silver-grain" are to be seen. The Horse-Chestnut (Fig. 32), the Box-tree (Fig. 105) and a great number of others do not display any pores which are visible to the naked eye, but it must not be concluded that the woods are Coniferous because the pores are not thus visible. The lens or even the microscope must be called in, when they will appear as minute apertures or grooves as the case may be. No Broad-leaved tree entirely lacks pores except a very curious tree called "Drimys chilensis" (Fig. 150), a relative of the Magnolias. Its fellow species (Drimys winteri), the "Winter's bark," sometimes exhibits a few, not always (112). These are extraordinary cases which are anomalous and require further study. Another such is Acacia juniperina (Fig. 153), which closely resembles the Coniferous type of wood inasmuch as it has a few isolated pores in a loose ring here and there, quite unlike any other species of Acacia (compare Fig. 43). It is interesting to note that a great many climbers superficially resemble each other in their wood, notwithstanding the fact that they may have no relation to each other. All their pores are of great size and extremely closely packed, and form a tissue which looks like lace in a thin section, but it is probable that if the pores were less over-grown and numerous, the arrangement appropriate to the genus would become apparent, because masses of crowded pores, which leave little room for any woody tissue, must bear a common aspect in whatever order the pores arise.

In all cases where the arrangement of the pores takes definite form, such as festoons, tree-like or flame-shaped groups, they strike the eye as an independent portion of the wood, especially when they are compacted together into masses by the "Soft-tissue" or short, thin-walled wood-cells (Woody parenchyma). The commonest form of "soft-tissue" is a coat of delicate cells which clothes the pores and appears as circles round their orifices, or as borders by their sides in a vertical section (plank-wise or quartered). If the latter sections be in the least oblique, as is usually the case, the soft-tissue looks like a tail or fringed continuation of the pore. Often the coat of soft-tissue is so narrow that it is only by careful search for these "continuations" that it can be detected. Inasmuch

as the oblique section of any figure exhibits greater breadth than a transverse section, it is a wise plan to use the knife freely in all directions to show up obscure details. This coat of soft-tissue may be traced in transverse section (across-grain) in all grades of complexity. The simple uniform sheath is sometimes laterally extended into wings or diamond-shaped patches having a large pore or pore-group as centre (Fig. 47), or into concentric rings, or oblique, cross-shaped or undulating lines or bands (Fig. 53), which look like designs in lace when viewed as transparent objects. Some are of great beauty and many are so characteristic that they at once declare that such a timber belongs to such and such a genus. For the most part the pores and soft-tissue together produce this tracery, but occasionally the soft-tissue is quite independent of the pores (Fig. 55), and nearly always is of a lighter colour than the ground tissue.

The term "soft-tissue," adopted from Gamble, is rather a defective expression, and I should not use it did I think that the word "parenchyma" served the purpose better. Nördlinger uses the word "weitlumige," which is difficult to express in English in a single word. Soft-tissue may be very hard tissue at times, but it is always softer than the wood fibres of the same timber, and to the lay mind the term has the advantage of conveying the meaning intended, for in looking at a section of wood no one would misapply it.

In its simplest form the soft-tissue occurs as odd cells scattered here and there, or as strings of single cells. If these strings be sufficiently numerous and confined to certain spots, they may form patches or bands. It is only when they constitute defined areas that they can be described by definite names, so mere sporadic cells, strings or shapeless indefinite patches will be referred to as such.

Gamble makes a provisional classification of the Leguminoseæ (Bean and Mimosa family), by means of their soft-tissue, and relies to some extent upon the breadth of the bands. This may suffice within the limits of the species found in India, but as soon as a larger field is entered upon it becomes inadequate. In many other species the breadth of the zone is extremely variable, and again some soft-tissue may be present in well developed rings, and yet be quite absent from the slowly grown wood (Fig. 145). Soft-tissue is usually present among the dense mass of pores in the pore-rings of woods that possess them, but it should not be considered in the same light as a zone enclosing the pores, but as the result of crowding, and may be ignored as of little significance. As the pores diminish towards the Autumn zone, and the intervals increase, the soft-tissue

will be seen to increase and develop its characteristic arrangement (Fig. 88).

Although many woods display great individuality in their characters, it must not be supposed that every wood can be clearly described so that it may be recognized on sight. Amongst a limited number of woods a description may suffice, but the larger the variety, and the more numerous the species of closely related woods, the more difficult their discrimination becomes, and it is as well to define the limits which are set by Nature in this respect. Just as the flowers of all species of Ash-tree are modelled upon the same plan, so is their wood. A few species of Ash may present some peculiarity, but most are practically indistinguishable from other members of the genus by the structure alone. The Common Elm cannot be mistaken for the American or White Elm (Figs. 107–109), though their structure proclaims their mutual relationship, but sufficiently precise language cannot be found to describe the difference between the wood of the latter and of the American Rock Elm. Again, all the members of the Silky-Oak family (Fig. 102) are sufficiently alike to be recognizable at a glance, but in many orders it is difficult to discover two genera bearing any resemblance to each other in their wood.

Besides all this, it must be clearly stated that no varieties such as are due to different conditions of growth, climate, locality or other external conditions, can be distinguished by their structure. It is hardly possible to find language which will enable a reader to tell Honduras from Tobasco Mahogany, or even American from African Mahogany. There are characters which strike the eye in the St. Domingo variety and distinguish it from the others, but let any one attempt to put upon paper a description which will enable a second person to tell for certain which is which, and he will admit that the time is not yet come to essay it. Nothing beyond the character of the species is attempted here, notwithstanding the fact that upon the log as it comes to market there are often indications of its origin. As these are for the most part the outcome of the dressing by human hands, and so are subject to alteration, they will be but lightly touched upon in the descriptive portion of this book.

Practical Hints

THE more familiar aspect of wood is of no less importance than the structure. The user of wood has from time immemorial relied upon the evidence of his unaided senses to tell one kind from another and, just as in other Arts, this rule-of-thumb method will always remain the chief factor in the discrimination of timbers. Science with its precise definitions and accurate instruments steps in only where common-sense stops short. A carpenter has no need for text-books to tell him the difference between Oak and Walnut, any more than a child has need for a work on Botany to tell a Daisy when he sees it, nor does the expert timber-merchant need anything beyond his impressions coupled with his experience, until he meets with a wood that he has never seen before. Here something more is needed. By noting minute details usually overlooked, so many more characters are added to the obvious features that a timber may be recognizably described. Certain misleading resemblances can thus be detected. For instance, the familiar American or Canary Whitewood (Fig. I) may be met with quite black, as witness a specimen in the Museum at Kew. Ebony, which should be black, is oftener brown with black stripes, and generally requires the assistance of black polish to assume its "ebon hue." Colour, though of prime importance, is so variable as to be unreliable at times. The coarseness of grain has already been dealt with, and can only furnish assistance when the known range of size of the pores, their shape, and relation to the section observed, are all carefully harmonized. The weight is a useful criterion if it be carefully ascertained when the wood is dry. Judging from various tables of the weights of timbers, it appears to be assumed in many quarters that each kind of wood has its own special weight per cubic foot, whereas it is difficult to find two pieces of wood of the same specific gravity, and the maximum and minimum for a species seems to get further apart as more specimens are examined. In the descriptive portion of this work the figures given are those which happen to be *on record*, but these limits are certain to be modified by more extended trials.

The different physical qualities of wood are more or less bound up together. The weight, the hardness and the density generally

vary much in the same proportion, as all depend upon the last. Exceptions there are in abundance, but they can generally be explained by variations in the structure or in the secretions. The hardness therefore is just as variable as the weight, and the senses are almost the only guide. The estimation of this quality is complicated by the fact that several properties or combinations of them are classed under one general term. The resistance of a wood to the saw is not of the same nature as that to the plane or knife, or to a pointed instrument like a nail, or a blunt one such as a hammer, or again as the resistance to wear by friction. There is the flinty hardness of Lignum-vitae (Guaiacum), the brittle hardness of Ebony, the tough hardness of Boxwood, due to the impressions made upon the senses by other qualities such as elasticity, fissibility, tenacity or toughness, in addition to hardness *per se*.

Amongst other features we must not overlook the compactness of grain, i.e. the density of the woody ground-tissue (wood-fibres), which contributes to our sense of the smoothness of the wood and to its coldness or warmth to the touch. Some woods feel like marble, others like wool. Further, we have often strong evidence from the smell or taste, so much so that we can tell Teak or Pencil Cedar with the eyes shut. The smell of the former is truly abominable while that of the other is delightfully sweet. It is said that fresh Teak is " fragrant " ; would it were so in the seasoned timber. The Pencil Cedar combines its sweetness of smell with sweetness of taste, as all who chew their pencils know. At the other extreme is Quassia wood, of which cups used to be turned, which imparted the bitterness of the wood to any liquid allowed to remain in them. Smell is the most fugitive of these characters and may sometimes have passed away in old dry wood, but for the most part it can be revived by making a fresh cut. Frequently the smell is only apparent during working or becomes much more powerful then. It may be accompanied by an irritating dust causing violent sneezing and running of the eyes, as in the Sneezewood of the Cape of Good Hope, or in a less degree in Blue Mahoe. Again, some woods are aromatic when burning, quite apart from the smell of the pyroligneous acid in the smoke, as witness the Sandalwood of which Chinese Joss-sticks are made. Inflammability ranges from the easily-lighted deal and Lignum-vitae, which will burn like a candle, to certain species of Eucalyptus, Jarrah, Blackbutt and Tallow-wood of N.S. Wales. These may certainly be made to burn, but as soon as the flame has gone off the carbonized remainder ceases to glow and expires as soon as it is left to itself. Australians say truly that it takes three sticks of Oak to burn one of Gum (17).

PRACTICAL HINTS

Durability and other serviceable qualities, which make wood commercially valuable, are not altogether germane to our subject, as they cannot be employed to identify timber; hence the reader is advised to consult other works if information be desired upon these points. Inasmuch, however, as they are useful facts and take up little space, a few lines have been devoted to them in the descriptive part of this book, especially in the case of the Colonial woods. Much time has been devoted to the compilation of the opinions of various observers in the hope that little known Colonial timbers may be tried, and that such trials may not be attempted blindfold.

Details of elasticity, breaking-strain, fuel-value, resistance to impact, etc., must also be sought elsewhere. The list of works consulted, given at the end of the book, may be of service in guiding the reader to this class of information.

For the purpose of discrimination the solid wood should be taken and all the information which it will afford considered first. There is nothing like the examination of the solid wood, for in it can be seen the structure undisturbed and the mutual relation of its parts. Thin sections are of great value, but when all is said the information they yield, over and above that which can be seen in the solid, is limited to one or two details. A thin section shows the relation of the elements in merely one plane, and to build up an image of a cube of wood from thin sections from three sides requires a considerable effort of mind, and the conclusion is generally false. This is the case when the cross section is cut accurately with its surface precisely at right angles to the vertical axis of the tree, but if it be in the least out of truth it can be absolutely misleading, for all the round orifices of the pores become oval and the rays become shortened and broadened. With the solid wood, on the other hand, an examination of all sides readily disposes of all ambiguity, as any inaccuracy of the cutting declares itself. Furthermore the thin section shows but one or two layers of cells separated from the subjacent layers which have a definite and important relation to them. This can, in most instances, be seen in the solid wood, as it is to a certain extent transparent.

The first precaution is to obtain a perfectly smooth surface upon the wood by means of a plane or knife. The blade must be *very* sharp, for the surface obtained by a dull blade has a quite different appearance. A polished surface is frequently sufficient to show all detail, and every piece of furniture should be overhauled in search of information, but it must never be forgotten that a part of the polishing process consists in filling up the pores with powdered pumice-stone, so that they appear to contain a light-coloured secretion. A turned

article, well finished, either polished or not, is nearly always a useful object to examine, but it is the most difficult to understand.

To plane a shaving from the transverse section (across grain) of a block of wood, an iron plane, having a screw adjustment to regulate the thickness of the cut, is a most useful tool. It is not necessary to make beautiful sections like those of Hough and Nördlinger. For everyday work sections half an inch wide are amply large enough, and if a number be made at a time a few pieces will be found to exhibit all that is needful. Wood cuts much more sweetly when green than when dry, and moistening will facilitate the work. With woods containing much tannin, ink is produced by the contact of the plane iron, thus spoiling the appearance of the section, so that glycerine should be used with these instead of water. Difficulty will be met with chiefly in three classes of woods, viz., those that are extremely soft and crumble; those that are extremely hard and defy the edge of the plane and the strength of the operator; and those which possess rays of a much more delicate texture than the rest of the wood. Sections from the last separate into as many fibres as there are rays, and need more skill than I have been able to bring to bear upon them. Presumably this accounts for the omission of most of these woods from Nördlinger's series, for he must have been in possession of some, as they were commonly employed in Germany during his lifetime. Sapwood is always easier to cut cleanly than heartwood, and wherever possible a portion of it should be included in the section. In one of the Ebonies (Diospyros melanoxylon) the heartwood is almost impossible to deal with, but the sapwood cuts very sweetly indeed. Nördlinger's section is from the sapwood, and is a little misleading unless the reason be well understood. In a collection of solid specimens, many will be found full of fine cracks at each end; and to obtain large sections it will be necessary to cut away the wood until a compact surface is reached, a proceeding which entails a greater sacrifice than a large section is worth, as the small pieces between the cracks may be sufficient for all purposes.

After cutting the section, which will leave the plane as a curly shaving, it should be placed upon a piece of glass and the free end moistened, water being gradually added as the section uncurls, as it will usually do unless it be wetted too suddenly. It may require assistance, but these matters suggest their own remedy. After moistening, it should be pressed in blotting-paper for a moment, the paper changed and put away for a while under slight pressure. The subsequent treatment may consist merely of laying between glass slips, or simply between papers, as Nördlinger does. For exhibition purposes or for photographing the section may be mounted in

balsam or glycerine jelly. Sections when used in the lantern, either mounted or unmounted, should always be protected by an alum bath. I have had many ruined by inexperienced operators. Sections of Hornbeam, Maple, and some other woods have a curious way of stretching prodigiously, owing to the lateral dilation of the cells of the rays. In contracting to their former size during drying they pull themselves to pieces, hence it is necessary to detach them from the glass on which they have been wetted while they are still moist, and to dry them without pressure.

I much prefer to examine the sections unmounted, i.e. dry, as the colours are changed by balsam and the detail is more difficult to see, moreover the gums and resins contained in the pores become dissolved in the process of preparation and the specimen loses much of its character. For the same reason I never stain a section except as an additional expedient. The purposes for which the thin sections are specially useful are to measure and count the rays and pores, to detect soft-tissue otherwise invisible, to decide whether the rays are of one or more rows of cells, and if they are denser or laxer than the surrounding tissue: all most valuable items of information from a scientific and descriptive point of view, and sometimes decisive in the matter of settling a doubtful point in identification, yet in practice rarely absolutely essential.

Measurement is the chief among these points, as in a by no means small number of orders the breadth of the rays ranges within certain definite limits. The conspicuous breadth of those of the Oaks, which can be measured with a rule, is markedly characteristic of the genus Quercus, and the same may be said of the whole of the order Proteaceæ or Silky Oak family. The other extreme is represented by the Australian Gum trees (Eucalypti), whose rays are so narrow and so numerous that they may occur to the number of twenty-two in the space of 1 mm. The pores in their turn range from less than 1 to 400 per sq. mm., and in the matter of size their variation is only less great than that of the rays, as, in the wood of the Silk-cotton tree (Bombax malabaricum), they are as large as pin-holes, while in the Common Boxwood, they can scarcely be counted under a two-inch lens. The measurement may be carried out with a micrometer, such as is used for microscopical purposes. This may be essential to the investigator, but I limit myself here to the tabulation of the various sizes by groups, after the manner of Nördlinger and Gamble. I have been urged to drop these empirical groups and to give the exact measurement in mm., but my aim and ambition is to interest many who are not professed botanists, and to bring to the work some who have had

no training in botany and who, I am certain, will part company with me if I expect them to expend valuable time in the laborious process of micrometric measurement. Moreover, to see the fine lines of the micrometer upon the image of wood sections mounted dry is a task in which I have not yet succeeded, and therefore the mounting in some medium becomes necessary. Even then the strain of seeing the micrometer lines upon the image of dark coloured woods is more than the eyesight can bear for any length of time. Measurement by groups, on the other hand, is a ready and simple method, but presupposes the possession of a series of similar sections of woods corresponding to the type of the group. For instance, I employ the Common Oak for 'Size or Group II.', and lay a thin section of that wood side by side with the specimen to be tested. If the largest pores of each are somewhat of the same size the latter is said to fall under Size II. If not, the other type sections representing other grades must be tried in succession until the correct one be found. This seems a rough method, but that it is the only practical one (and a very useful one) will soon be seen when the great variation of the elements in the annual rings of various ages, already discussed, is taken into account. The type species which I have adopted are taken from Nördlinger's list, and are, as far as possible, common or readily obtainable woods, a principle I have adhered to in the preparation of the scales of measurement of the rays and also of the grade of hardness of woods. Gamble employs scales of the same nature. I have been prompted to use Nördlinger's scales by the desire for uniformity, so that any student may use my figures in conjunction with the greater work without the labour of translating every measurement.

The counting of the rays and pores is most conveniently done by means of a perforated piece of tin-foil having a hole exactly 1 sq. mm. in area. When this is superimposed upon the section to be tested, and one side of the square brought parallel to the rays, the latter may be readily counted, and further, as the pores are usually separated into narrow areas by the rays, the latter assist in guiding the eye, thus saving the annoyance of losing count. My practice, upon which the figures given in the descriptive portion of the book are based, is to search for the part where fewest rays or pores occur, and afterwards for that part where they are most numerous. These give the minimum and maximum figures for the specimen, which may be modified by subsequent observation upon other specimens when they are available. Another figure necessary for our purpose is the number of pores in the individual groups, i.e. in actual contact with each other. These groups are of the two kinds already mentioned, the subdivided or mother-and-daughter groups, and

the simple type, which seem to have arisen independently yet closely pressed against each other.

If the pores are large and the rays seem to avoid them, the latter may be said to be less than a pore's width apart, and *vice vèrsa.* These terms stand for definite divisions between the species of woods, as will be seen later, and in addition form convenient *points d'appui* when accurate measurement is not immediately possible.

Whenever the soft-tissue is arranged in bands or lines susceptible of measurement, the same scale can be used as that arranged for the rays.

All the preceding matter has been written exclusively in connexion with the transverse section. The two other sections may be treated in precisely the same way, but of course the details differ. The height of the rays in tangential section requires measuring, and is here expressed in fractions of a mm. The soft-tissue and the contents of the pores also require special attention. In the case of some Conifers the horizontal resin-canals are more easily located in the tangential section.

Thin sections in a vertical direction are only possible with woods with extremely fine pores, otherwise they fall into narrow strips divided by all pores whose depth is greater than the thickness of the section. For exhibition purposes the wood may be cut in a slightly oblique direction, so that the open pore does not run the whole length of the thin film, which will then hold together. Coniferous woods seldom fall to pieces from this cause, and many excellent sections may be picked up from the floor of a joiner's shop. Similarly I have often caught a handful of beautiful transverse and other sections as they streamed in ribbons from the turner's chisels.

A fascinating method of study is to be found in the use of the lantern, and I am almost persuaded to say that it is preferable to the microscope, as the broad grasp of the structure of the wood which the lantern affords makes a great impression upon the mind. Instead of the limited field of view of the microscope, which necessitates the removal of one portion of the section in order that another may come into view, the whole section is displayed at one time, and the broad rings compared with the narrow; misleading impressions being thereby dissipated. After seeing a section of Oak thrown upon the screen the observer feels that he will recognize the wood again even if he does not possess sufficient knowledge of the structure to analyze its parts. In addition, the absence of the strain upon the eyes entailed by prolonged work at the microscope is avoided, and the facility for pointing out and discussing details with a second person makes this method of inestimable value. Again, it is scarcely

possible to compare more than a limited portion of one specimen with another under the miscroscope, whereas they can both be thrown upon the screen side by side in their entirety. I have done much work with a small lantern illuminated by the ordinary Welsbach incandescent light and a screen about four feet square. I have in this manner studied the whole of Nördlinger's 1,100 sections without injury to them by placing each section between two pieces of glass, which were slid into the lantern in the place of the slide-carrier.

One detail, which will be found in each description of the separate species, is the colour of the solution produced by boiling the wood in water or alcohol. As is well known, water dissolves gums but not resins, whereas alcohol dissolves resins but not gums. By first boiling a few shavings in water and afterwards boiling them in alcohol, both resins and gums are extracted. Pigments of various kinds are sometimes more soluble in the one fluid than in the other, and frequently yield useful information. I make no attempt to enter into the chemical questions that arise from these experiments, but if it be necessary to decide whether a gum be present it can be readily done by noting the white precipitate formed in a solution in water upon the addition of alcohol, and *vice vêrsa*.

Tannin may be detected by the application of any iron salt in solution, a test which may prove useful when it is desired to find a wood which will not corrode iron. A solution of caustic potash is a handy reagent, and is indispensable for the testing of the coloured solutions obtained from the wood by extracting with water or alcohol. To those who desire to go more deeply into this fascinating and little-worked branch of the subject, I recommend a little work of great merit by Dr. J. Lauterer (62) as a model of what can and should be done in this way. Items of interest can also frequently be picked up in books upon dyeing, in which the treatment of the various dye-woods, Fustic, Logwood, etc., afford many useful hints. As there are a number of medicinal woods, such as Guaiacum and Quassia, included in the British Pharmacopœia, that work may be searched with profit. Compared with other branches, this has been well worked, parallel methods to those described in this book being employed in identifying many of our useful drugs and detecting adulterations. Wiesner's fine work (131) should be consulted on these points.

After noting as much as can be seen with the naked eye a pocket lens should be used and will reveal a marvellous amount of detail. In nine cases out of ten it will show all that is needed for the purpose of identifying a wood, for which there is much to be thankful, as a small pocket lens can be a constant

companion. When available a condensing lens is useful to throw a brilliant spot of light upon the wood, and in all cases the surface should be moistened, as the wetting emphasizes certain parts by deepening their colour and throwing them into relief. With the solid wood such stains as are commonly employed by microscopists seldom yield good results, as even when they single out certain kinds of tissue and avoid others there is sure to be some different kind in the next layer beneath which brings the whole back to a uniform colour. Nevertheless Perchloride of Iron may be employed to advantage, as it sometimes shows up the rays of certain species.

When a good idea of the general structure has been obtained by means of the lens, the microscope may be used. A low power is sufficient, as, for instance, a two-inch Swift, which will show the shape of the pores and rays, and will serve to measure them and to count their number.

Seen under the microscope by reflected light, a piece of wood is a beautiful object, and some of the coloured woods, such as Mahogany, are most brilliant and even gorgeous, for the play of colour from the resin or gum, and the different hues of the various kinds of tissue are most agreeable to dwell upon.

For low powers I use a simple contrivance consisting of a tube some ten inches long, fitted to receive an ordinary microscope eye-piece at one end, and reduced to take the objective at the other. Upon the lens or lower end is lightly telescoped a piece of tube, some five inches long, of which one side, to the length of two inches, is removed to allow the light to fall upon the wood. This outer tube is to regulate the distance between the lens and the wood, so that by resting it upon the surface the latter is immediately brought into focus. The advantage of this simple apparatus is that any block of wood can be examined without the trouble of reducing it to a size small enough to go on to the stage of a microscope. Besides it is not always convenient to cut a specimen, so that this is a practically indispensable form of instrument, if the specimens in a museum are to be examined microscopically. A minor recommendation is that it can be slipped into the pocket. I need not touch upon the use of the higher powers of magnification, for although they are no doubt essential in describing the structure, they are by no means so in recognizing it, and I wish to impress upon my readers most strongly that they need not be deterred from this study by the feeling that the work needs special training, for the pocket lens will carry them along for nine-tenths of the road, and for the most part they need not use the microscope at all, though I promise them that the fascination of the work will soon lead them to employ it. If so small a

matter needs mentioning, it should be remarked that a hand-lens should be used quite close to the eye, and the wood brought up to it until it comes into focus.

The weight per cubic foot is a detail which can nearly always be ascertained by trimming and measuring the block, but if the wood be not dry it should be put aside and weighed from time to time until it ceases to diminish in weight. A rough method of estimation is to plane or turn a stick truly parallel from end to end, and to lower it gently by means of a thread into water until the thread slackens (87). The point to which it sinks is then marked and measured, and as the whole length of the stick is to 62½ (the weight of a cubic foot of water in lbs.) so is the length of the wetted portion to the number of pounds per cubic foot. If the figure 1000 be used instead of 62½, then the apparent specific gravity will be arrived at (1000 ounces = 62½ lbs.). If an irregular block be thrown into the water, a trained observer can get very near to the weight per cubic foot by noting the bulk submerged. These are not scientific methods, but they are often useful when apparatus is not to hand. A better expedient is to employ a graduated glass filled to a certain height with water, in which the wood can be immersed. The bulk of water so displaced is a basis for working out the specific gravity, except when the wood sinks entirely. It is not possible to get rid of bubbles which buoy the wood up, or to allow for the water the wood will absorb. The use of Mercury gets rid of two of the objections, but not of that due to the bubbles, besides which the wood has to be forcibly held beneath the surface while the scale is read off. Hartig, I understand, used a strong solution of Chloride of Lime and water, of a given density, and so avoided all three difficulties, but a new one was created by the salt which crystallised out on the fine fibres of the wood and increased its apparent bulk. All my own weights have been obtained by planing up the block quite truly, and carefully measuring, but in no case do I give a less fraction than ¼ lb. per cubic foot, as this much variation can be observed in specimens taken from different parts of the same tree. I have added figures compiled from all possible sources, but quote only those which stand for the maximum and minimum recorded for the species.

Smell and taste are not susceptible of measurement, and can only be vaguely expressed by comparison with familiar impressions. I have been accustomed to classify tastes as Sweet (Pencil Cedar), insipid (Spruce), resinous (Pitch Pine), astringent (Oak), bitter (Quassia), and nauseous (Sneeze wood). Scents I have dealt with roughly in the same way, but each observer will be forced to make a scale to suit himself.

The burning of wood may be conveniently tested by taking a splinter cleft from a block, and lighting it like a match. If it burns while held upright, it burns *well*: if it goes out, and requires repeatedly relighting, it burns *badly*. The residue may be, as is usual, a glowing cinder which consumes away to the ash, or may remain, as in the case of the Sweet Chestnut and the Jarrah, a black carbonized stick. Crackling, spitting, or even slight explosions (Spruce) may occur, caused by the heated secretions in the wood forcing the fibres apart. The aroma while burning, as already mentioned, should be noticed, because in cases like the Dalbergias (True Rosewoods) the tarry smell is practically a generic character. Certain juices, melted gums or resins, come bubbling and spitting out of the pores, and their colour furnishes evidence of some value.

The hardness of timber is unfortunately just as much dependent upon our impressions as are taste and smell, but its commercial importance is much greater, hence many attempts have been made to express a scale of hardness in words.

Nördlinger expressed it in figures corresponding with the weight of sawdust removed by a given number of strokes of a saw; another observer employed a rasp; a third turned balls of the wood to be tested, and measured the distance they rebounded when dropped from a given height; another (Hough, I believe) dropped a pointed weight upon the wood and measured the depth of indentation. The methods are all useless because Nördlinger's saw (to say nothing of his biceps) is needed to produce the same result, and the saw must always be equally keen; and the like with the rasp. Again, the turned ball could never be reproduced exactly, even in the same wood, and in most woods a ball would soon become distorted by warping. By Hough's method the bottom of the depression made by the impact of the point would rise up in some woods from their elasticity, while in others it would remain deeply impressed. My own method, though more complicated, presupposes nothing that cannot be reproduced by others, but unfortunately it requires a machine of considerable complexity, which, as I have had no leisure so far to make exhaustive researches in this direction, is merely described in the Appendix. After all, it is not hardness alone that is measured, but more accurately the resistance to impact, spoken of by Hough, or, in other words, the amount of force which wood will absorb when struck. We are, therefore, thrown back upon vague terms, such as "hard," "very hard," "moderately hard," etc., etc., coupled with the names of a few well-known woods for comparison, so that they are not quite empty words. Gamble's scale of hardness, expressed in this fashion, is good, but

cannot be used by English readers, as his standard woods are all Indian. I have, therefore, used Nördlinger's scale, in which the type species are chiefly familiar European woods, and as it embraces a longer and rather more convenient series. I cannot say that it is at all uniform when tested by accurate means, but I am loath to pile another empirical scheme upon those already in existence, without more substantial gain than appears in sight at present. A rough method, not to be despised, as a test for hardness (?), is to try the wood upon the transverse section (across-grain) with the finger nail. The amount of resistance felt, and the depth of the mark made, give a ready and not at all inaccurate means of comparison.

The surface of a wood depends much upon the density and compactness of the wood fibres, and the size of the pores. The "feel" of a wood is always present amongst our impressions but cannot be gauged. Ebony and Boxwood feel smooth and cold, Spruce feels warm, and one wood called "Kretti," from British Guiana, feels velvety. Of lustre there are many degrees and also several kinds. The pearly lusfre of the Spruce, the frosted lustre of the Autumn wood of the Pencil Cedar, when cleft tangentially, the glassy lustre of the Acacia (Robinia), the greasy lustre of the Lignum vitae are familiar instances. It is sometimes difficult, as in the case of the Oak, to determine whether the flakes of the Silver-grain are either dull or lustrous, though the ground-tissue clearly reflects the light. In most species the ground-tissue reflects the most light, and the Silver-grain appears dull by contrast. In Ebony, on the contrary, this order is reversed, as the Rays or Silver-grain appear bright against the otherwise very dull wood.

It is rather a difficult matter to define the term "Grain." Strictly it signifies the fibre of wood, but in this book it is rather a measure of the size of the pores between the fibres than a description of the relative position of the fibres themselves. Open grain (Oak) shows empty pores, while in even grain (Rosewood) they are filled with a secretion. The Oak is coarse grained and the Beech is fine.

For the identification of one out of a large number of species a Key, or some other means of classification, is a necessity. In many works of systematic botany a Key is provided in addition to a well-developed scheme based upon the natural relationship of plants. Unfortunately, such Keys as exist at present are of a very limited extent, being confined to special groups or arbitrary lists of woods. The most serious attempt is that of Nördlinger, already referred to, but the difficulties of using it are very great; and it is altogether unconvincing. Such a Key can as yet be but

artificial, as the material is largely unworked; but I trust and believe that the future will provide material for an advance in the right direction. Little attempt has been made to classify woods according to their structure; yet there are characters which seem to have a distinct systematic value. The primary distinction between the wood of the Monocotyledonous trees (Endogens) and that of the Broad-leaved Trees and the Conifers is very definite and well known. The next, between the wood of the two latter groups, is equally emphatic and in accordance with the natural system. Up to this point the structure of the wood has long been accepted as being of equal systematic value to that of any other part of the plant. Taking the Conifers in their turn, there are reliable differences between the woods of the Pines and their allies and those of the Cedars, Cypresses, etc., and there is a further sharp distinction between those Coniferous woods with vertical resin canals and those in which they fail. But when dealing with the wood of the Broad-leaved trees the systematic botanists cannot be followed; and though characters run through long series of species, genera, and even orders, there are so many exceptions that the task of reducing them to an orderly arrangement seems almost impossible.

It is not unnatural to assume that woods possessing two kinds of rays should be grouped apart from those having but one kind; but by separating them we cut off the Cupuliferæ, the Casuarineæ and the Proteaceæ, and perhaps many other orders yet unworked, from the remainder of the Broad-leaved trees, making an artificial group of unrelated plants. Therefore our classification cannot be based upon this feature. The arrangement of the pores is very characteristic of many orders, and is very constant throughout long series of species, as the Cupuliferæ, the Myrtaceæ, the Proteaceæ and the Urticaceæ, but similar arrangements of the pores can be found in quite unrelated orders.

Again, the soft-tissue or wood parenchyma is equally casual in its appearance, and, from the study of Solereder's work I conclude that the minute structure of the wood, the pitting of the cells, etc., is also unsuitable as a basis.

Any one of the various kinds of tissue may be absent except the wood fibres and the rays, and the following alternatives may be found—

1. Wood fibres and rays.
2. Wood fibres, rays, and pores (vessels).
3. Wood fibres, rays, pores. and soft-tissue (wood parenchyma).
4. Wood fibres, rays of two kinds, and soft-tissue.
5. Wood fibres, rays of two kinds and soft tissue of two systems.

6. Wood fibres, rays of two kinds, no pores, but vertical resin-canals.

7. Wood fibres, rays of two kinds, but no pores (vessels) or resin-canals.

The first class may be neglected as being rare, but the others are very constant, and the presence or absence of one or more of these tissue-systems may serve as a foundation upon which to build a Key.

PLATE I.

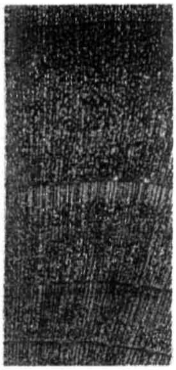


Fig. 1.
Liriodendron (Canary White-wood).

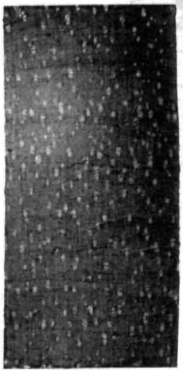


Fig. 2.
Duguitia (Lancewood).

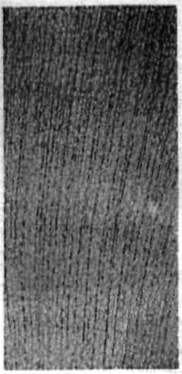


Fig. 3.
Kiggelaria.

Fig. 4.
Xylosma.

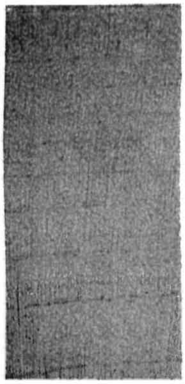


Fig. 5.
Scolopia.

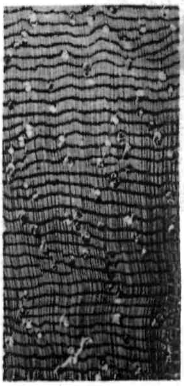


Fig. 6.
Lophira (African Oak)

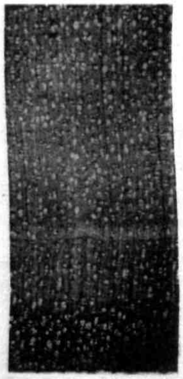


Fig. 7.
Hibiscus (Mahoe).

Fig. 8.
Plagianthus.

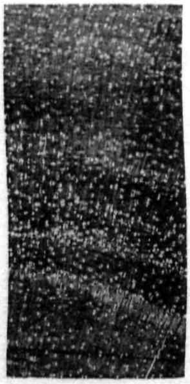


Fig. 9.
Thespesia.

No. 1. CANARY WHITEWOOD. Liriodendron tulipifera. Linn.

PLATE I. FIG. 1.

Natural Order. Magnoliaceæ.

Synonyms. L. procera. Salisb. : L. tulipiflora. St. L.: Tulipifera Liriodendron. Mill.

Sources of Supply. The United States of America and Canada.

Alternative Names. Whitewood, Canadian Whitewood, Tulip Tree, Canary wood, Poplar, Yellow Poplar, Virginian Poplar, Canoe-wood, Yellow-wood, Saddle Tree (12).

Physical Characters. Weight 26½ to 38½ lb. per cu. ft. Hardness, Grade 7, soft, compare English Alder. No smell or taste. Burns well and quietly, embers glow in still air. Solution with water or alcohol colourless.

Grain. Very fine but spongy : splits cleanly. Surface dull, the little lustre being due to the shining pores, soils readily.

Bark. Very thick, as much as 1 inch, corky, deeply fissured, 2 layers. The inner layer of the bark is so much like the wood itself that it may be overlooked, it is about ¼ inch thick in old trees, and nearly white in colour. The scales which fall off are clearly marked in transverse section.

Uses, etc. " In works of construction, interior finish, shingles, boat-building, wooden pumps (in the United States). Not strong, brittle, easily worked" (100). " Not liable to warp and shrink, durable" (95). Panels, sideboards and in joinery generally, in England. Met with in the form of waney logs and sawn planks of fine dimensions. " A tree of 30 to 60 metres high by 2·4 diam." (100).

Authorities. Nördlinger (86), vol. 3, p. 55. Laslett (60), p. 184. Boulger (12–15). Hough (49), part I. p. 40. Sargent (100), No. 8. Robb (95). Wiesner (131). L. 12, p. 914. The wood is frequently confused with the American White Poplar, Sycamore (English) and other whitish woods.

Colour. White, canary-colour, greenish, or grey : " Sap-wood whitish or brownish" (131).

Anatomical Characters. Transverse section ;—

Pores. Just visible, fine, size 4 : uniformly distributed, occupying almost the whole ring : somewhat variable in size : numerous,

100–150 per sq. mm.: the large ones predominating: arranged in loose, radial lines, often nested in groups of as many as 14.

Rays. Just visible? fine: uniform in size: tapering extremely gradually: many, 7–12 per mm.: colourless: slightly denser than the ground tissue: direct in their course: more than a pore-width apart yet avoiding the pores.

Rings. Clear on account of a very fine boundary line of Autumn wood only. Contour round or gently undulating: a slight difference in shade between the Spring and Autumn wood.

The *Ground-tissue* is all more or less wide meshed.

Pith, 2 to 4 mm. thick, rounded, white.

Radial Section. The pores need the lens and are fine, shining, colourless lines. The rays are just visible in a certain light as extremely narrow lines or flakes. The rings are visible as fine colourless lines.

Tangential Section. The rays are extremely fine, colourless lines about 5 mm. high, otherwise as the Radial section.

No. 2. LANCEWOOD. Duguetia quitarensis. Benth.

PLATE I. FIG. 2.

Natural Order. Anonaceæ.

Synonyms. Guatteria quitarensis. G. virgata. Dunal. Oxandra virgata. Rich. Uvaria lanceolata? (see Royle in 48).

Alternative Names. Jamaica and Cuba Lancewood. Beriba in Guiana (76). Yaya in Honduras (12). Yariyari (131).

Source of Supply. The West Indies.

Physical Characters, etc. Weight 52–63 lb. per cu. ft. Hardness Grade 2, compare Boxwood. Smell none, taste faintly astringent. Burns well with a lively spluttering flame, embers glow in still air, the heat expels a red gum or resin. Solution with water, alcohol, or potash, colourless.

Grain. Very fine and dense. Surface lustrous, the rays and pores dull, but not sufficiently prominent to affect the lustre of the ground tissue. Cold to the touch.

Bark. (Jamaica variety.)—⅛ inch thick, smooth with coarse wrinkles, scarious: rays continued into the bark in the form of a blunt, converging pencil of about 100 rays each. (Cuba variety.)—⅛ inch thick, smooth with narrow shallow wrinkles, rays as above in pencils of about 12 rays each.

Uses, etc. Lances, shafts, spars, fishing-rods, ramrods, general turnery, etc., etc. Tough, strong, and elastic. Seldom of any considerable size. Imported into England in the form of small logs or spars. Often confused with Degame wood. No. 125.

Authorities. Holtzapfel (48), p. 89. Boulger (12), p. 437. Wiesner (131), L. 6, p. 72. J. Leman (64).

Colour. White, greyish to yellowish, uniform : no difference between sap- and heart-wood.

Anatomical Characters. Transverse section :—

Pores. Need lens, uniform and evenly distributed : here and there a zone poorer in pores : single or in compact radial groups of as many as 8 : numerous, 80–140 per sq. mm. : round : a tendency to a linear arrangement between the rays.

Rays. Just visible, size 5–6, uniform and equidistant : straight or curved but not avoiding the pores : numerous, 6–10 per sq. mm. : long, rarely tapering : less dense than the ground-tissue : white : a pore-width or more apart. (The Jamaica variety has rays with two rows of rectangular cells.)

Rings. Very doubtful : at most a line of contrast between zones richer or poorer in pores.

Soft-tissue. Abundant and characteristic : fine white lines linking the rays like the rungs of a ladder : need lens : width finer than size 6 : also many isolated wide-meshed cells (or patches in the Cuban variety) or cells arranged in radial lines : also neatly and very narrowly encircling the pores.

There are often jet-black patches like ebony resembling flakes ; (see Fig. 179, Plate XXII), but which do not distort the structure in any way.

Radial Section. Pores inconspicuous grooves, often shining ; rays ; fine whitish flakes very inconspicuous, dull ; rings ; mostly indistinct but occasionally traceable : the black areas appear as very sharply defined black lines *when present.*

Tangential Section. Rays invisible without micro., fine line about 0·5 mm. high.

No. 3. NATAL MAHOGANY. Kiggelaria Dregeana. Turcz.

PLATE I. FIG. 3.

Natural Order. Bixineæ.

Synonyms. K. glandulosa, Salisb. K. integrifolia, Jacq.

Source of Supply. South Africa, Natal.

Physical Characters, etc. Recorded dry-weight, 48 lbs. per cu. ft. Hardness Grade 7, compare English Birch. Taste none. Smell none when dry. Burns moderately well with a peculiar and somewhat unpleasant aroma, embers glow in still air, heat expels a brown gum. Solution rich, the colour of the wood, deepening upon the addition of potash.

Bark. Greyish-brown, about ⅛ inch thick with fine, shallow fissures : closely adherent : has a smooth appearance at a distance : whitish internally and full of whitish-brown rods arranged in radial rows between the rays which are continued into the bark.

Grain. Fine, compact and even. Surface slightly lustrous.

Uses, etc. Unrecorded. Saws very hard and planes badly. My specimen was shattered by cracks when received. As other species prepared and kept under identical conditions were sound, it may be presumed that this wood is difficult to season.

Authorities. Nördlinger (86), vol. 7, p. 79.

Colour. Uniform, light mahogany-coloured heart-wood fairly defined from the brownish-white sap-wood which is about $\frac{1}{8}$–$\frac{3}{16}$ inch wide. "Yellowish-red" (86).

Anatomical characters. As Xylosma monospora but widely different *in appearance*, and with the following variations :—

Pores. Visible, size 3–4: 30–50 per sq. mm. : no two-rowed groups.

Rays. Just visible, size 5 : the difference in size between the "middles" and "ends" not so considerable as in Xylosma. The former 2–5 per mm., or both together 8–12 per mm.

Ground-tissue. Very coarse.

Soft-tissue. Narrowly encircling the pores.

Radial Section. Pores, fine scratches, scarcely visible. Rays, inconspicuous but pretty brown flakes. Rings, scarcely discernible.

Tangential Section. As the Radial, but the rays need lens and are fine, brown, spindle-shaped bodies of coarse texture, and about 1 mm. high. Rings scarcely perceptible, but there may occasionally be seen a zone of slightly denser wood.

Type specimen authenticated by the Forest Officer to the Government of Natal.

No. 4. BOGABOG-U-VETO. Xylosma monospora. Harv.

PLATE 1. FIG. 4.

Natural Order. Bixinæe.

Source of Supply. South Africa, Natal.

Physical Characters, etc. Recorded dry-weight, 35$\frac{1}{4}$lbs. per cu. ft. Hardness Grade 8, compare White Pine. Smell, none when dry. Taste astringent. Burns well with a peculiar aroma, embers glow brightly in still air. Solution brownish, deepening upon the addition of potash.

Grain. Fine but open. Surface, scarcely bright and of a coarse texture.

Bark. Greenish-brown, about $\frac{1}{8}$ inch thick, wrinkled, consisting of a soft, spongy layer, covered by a thin, shiny skin.

Uses, etc. Unrecorded. Saws very easily but with a woolly surface. Retains its moisture for a long time, judging by the

condition of my specimen, which was cut at the same time as other woods perfectly dry at the time of writing.

Colour. Heart-wood greenish or greenish-brown gradually passing into the lighter sap-wood.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 4, some variation : irregularly and thinly scattered singly or in radial groups of 2–15 pores between the rays : few, 20–40 mm. The larger groups are sometimes two-rowed.

Rays. Readily visible, size 2-3, apparently of two sizes, but the smaller, I believe, are the attenuated ends of the larger : sometimes of different colour in the same ray. "Middles," size 2–3 and 1–3 per mm. or with "ends" together, 7–8 per mm. : very lax and lighter in colour than the ground-tissue.

Rings. Vague.

Soft-tissue. In scattered cells only.

Pith. ?

Radial Section. Pores, fine open scratches. Rays, readily visible or even prominent brown flakes.

Tangential Section. As the Radial, but the rays are broadly spindle-shaped bodies about ⅛ inch high of coarse, brown cells large enough to be seen with the lens.

Type specimen authenticated by the Forest Officer to the Government of Natal.

No. 5. RED PEAR. Scolopia Mundtii. Arn. (Warb).

(Not mentioned in the *Index Kewensis.*)

Plate I. Fig. 5.

Natural Order. Bixineæ.

Synonyms. S. Zeyheri. Arn. (Warb.). S. Ecklonii. Arn. (Warb.) (131). Neither of these are mentioned in the *I.K.* Phoberos Mundtii. Harv. et Presl. P. Ecklonii. Presl.

Alternative Names. Klipdoorn (21). Thorn (12).

Source of Supply. South Africa, Natal.

Physical Characters, etc. Recorded dry-weight, 50 lbs. per cu. ft. Hardness Grade 7, compare English Beech. Smell or taste none. Burns well with a faint aroma, an unusually copious yellow juice expelled by heat, embers glow in still air. Solution pinkish, the colour of the transverse section of the wood, darkening to port-wine colour upon the addition of potash : no ppt.

Grain. Fine though open. Surface not bright.

Bark. Light-brown, about ⅛ inch thick, of one layer, wrinkled, hard, compact, woody : filled with white rod-like bodies.

Uses, etc. "Hard and durable" (131). "Building timber" (21). "Wagons, —— timber to 3 ft. in diameter" (19). Saws

easily: planes extremely readily and well though the wood is tough and firm.

Authorities. Wiesner (131). L. p. 119. Kew Guide (57), p. 56. Charpentier (21), p. 137. Laslett (61), p. 441. Nördlinger (86), vol. 7. p. 19. Cape Land Almanack (19).

Colour. Quite uniform, delicate reddish-brown: heart-wood not very well defined from the lighter sap-wood, which is about ¾ inch wide.

Anatomical Characters. Transverse section :—

Pores. Just visible with lens, size 4, uniform: scattered, mostly single, a few subdivided pairs and threes between the rays, but sometimes loose rows of as many as 9: few 30–60 per sq. mm.

Rays. Need lens, size 4–5; uniform though apparently of two sizes: stout in the middle, but tapering to fine points both ends: "middles" 3–5 per mm., or "middles and ends" together 10–15 mm.

Rings. Vague: boundaries not visible in the solid but indicated by a difference in the density of one zone and the next as they resist the knife unequally.

Soft-tissue. Needs the microscope.

Pith. ?

Radial Section. Pores, extremely fine, lustrous scratches: need lens but to good sight they appear as fine frost-like points. Rays just visible in certain lights.

Tangential Section as the Radial, but the rays appear as minute red lines about 0·2 mm. high: just visible with the lens.

Type specimen authenticated by the Forest Officer to the Government of Natal.

No. 6. AFRICAN OAK. Lophira alata. Banks.

PLATE I. FIG. 6.

Natural Order. Dipterocarpeæ.

Synonyms. L. simplex. G. Don. L. africana. Loudon.

Alternative Names. Scrubby Oak (Henfrey): Laintlaintain: Meui: Millai in Sierra Leona (107).

Sources of Supply. Gold Coast: Lagos.

Physical Characters, etc. Recorded dry-weight 67–72 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Burns very well with a noisy, explosive flame, embers glow in still air and consume very slowly to the ash, no particular aroma. Solution colourless: the watery solution becomes deep red with potash: the alcoholic brown, with a ppt.

Grain. Coarse and open. Surface lustrous.

Bark. Bright brown, about ¼ inch thick: of one layer: filled

with coarse, hard bodies and exhibiting the continuations of the rays in transverse section.

Uses, etc. A very showy furniture and turner's wood.

Authorities. Scott-Elliott & Raisin (107). *Henfrey's Botany*, 3rd ed., p. 225. Kew (56).

Colour. Deep red like dried blood, with chalky lines. No distinction between sap- and heart-wood.

Anatomical Characters. Transverse section :—

Pores. Conspicuous on account of their size and whitish contents, size 1–2, uniform except within the groups but increasing in average size as the tree ages : in subdivided groups of 2–5 whitish pores mostly in threes : few, 1-6 per sq. mm. : many filled with a whitish substance and a few with red gum, but for the most part empty.

Rays. Need lens, fine, size 6, finer than in any other species observed : very many, 5-8 per mm. : sinuous often 3 to the pore-width : not avoiding the pores.

Rings. Doubtful.

Soft-tissue. Very clear in innumerable, fine, close, concentric, undulating, continuous lines rather lighter in colour than the ground-tissue and 1-2 per mm.

Pith. Large, about ¼ inch diameter, hard, rather lighter in colour than the wood.

Radial Section. Pores ; coarse grooves, very conspicuous when filled with the whitish deposit which gives the wood its remarkable character. Rays ; vague, shadowy, minute flakes. Soft-tissue in close, fine, regular, vertical lines.

Tangential Sections. The soft-tissue appears in the form of beautiful waved or zigzag lines : pale and inconspicuous though readily visible. Plate XXI, Fig. 174.

Type specimens from commercial sources, except one from the Governor of Lagos, which is authenticated only as regards its local name.

This species is usually confused by name with No. 170.

No. 7. LACE-BARK. Plagianthus betulinus. A. Cunn.

PLATE I. FIG. 8.

Natural Order. Malvaceæ.

Source of Supply. New Zealand only.

Alternative Names. Houi (A.G.). Powhiwhi (12).

Physical Characters, etc. Recorded dry-weight, 36½ lbs. per cu. ft. Hardness Grade 7, compare Spruce. Smell ? My specimens smell musty, but I suspect that this arises from the presence of decay in the sap-wood. Taste little if any. Burns

very well, no aroma, embers glow in still air and the sound wood smoulders away like touchwood. Solution colourless : not coloured by potash.

Grain. Very fine and even : surface very dull except that of the rays, which is lustrous.

Bark. Brown, ¼–½ inch thick, of two layers : the outer consisting of small irregular, crumbling, corky scales : the inner of many layers of lace-like bast readily separating and riddled with spindle-shaped perforations caused by the continuations of the rays into the bark.

Uses, etc. Doubtful : not recorded. Works very easily and smoothly and has a pretty figure when quartered.

Authority. Boulger (12), p. 480.

Colour. Heart-wood whitish-brown, not very sharply defined from the 1½–2 inches of apparently perishable sap-wood.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 4, little variation : in concave (dentate) festoons like the rungs of a ladder between the rays and confined to a narrow zone of soft-tissue : 70–120 per mm. : isolated : round.

Rays. Prominent, size 2–3, uniform : few, 1–7 per mm. : tapering both ends to fine points : curved but not avoiding the pores : white.

Rings. Clear if indicated by the loops of soft-tissue.

Soft-tissue. In festoons between the rays in numerous continuous, concentric zones of contour forming a beautiful tracery with the rays.

Radial Section. Pores; need lens, very fine scratches only. Rays; readily-visible, white flakes. Soft-tissue visible in a close, regular series of fine white, parallel lines.

Tangential Section as the Radial. The rays are not easily seen except under the bark where they penetrate the layers of bast : about 1½ mm. high. The soft-tissue is much less prominent.

Type specimen authenticated by the Forest Officer to the Government of New Zealand (A.G.).

No. 8. LACE-BARK. Hoheria populnea. A. Cunn.

PLATE XVIII. FIG. 157.

Natural Order. Malvaceæ.

Source of Supply. New Zealand only.

Alternative Names. Whau Whi (A.G.). Powhiwhi : Ribbonwood (12).

Physical Characters, etc. Recorded dry-weight, 42 lbs.

per cu. ft. Hardnes Grade 8, compare White Pine but of a brittle nature. Taste or smell none. Burns well with little aroma: embers glow in still air. Solution colourless, not changed by potash.

Grain. Rather coarse and open. Surface coarse and dull excepting that of the silver-grain.

Bark. Light coloured, smooth, about $\frac{1}{32}$–$\frac{1}{8}$ inch thick, whitish or yellowish-brown with many exquisite thin layers of lace-like bast riddled with spindle-shaped perforations caused by the continuation of the rays through to the bark.

Authorities. The Agent-General for New Zealand (A.G.), Boulger (12).

Colour. Brown as to the ground-tissue, white as to the silver-grain.

Anatomical characters as those of Plagianthus betulinus except the size of the elements, the rays in particular being much bolder. Pores, size 3–4 and 35–60 per sq. mm.: Rays, size 2, and 1 or at most two per mm.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 9. BLUE MAHOE. Hibiscus elatus. Sw.

PLATE I. FIG. 9.

Natural Order. Malvaceæ.

Synonyms. Paritium elatum. Dow. (The Hibiscus elatus of De Candolle is H. tiliaceus, Linn. and not this species.)

Alternative Names. Majagna in Cuba. Maubo do Mato in N. Prov. Brazil (76). Mountain Mahoe: Tulip Tree in West Indies (64): Tall Hibiscus: Grand Mahot: Bois de Liege in Barbadoes (105)? Mahoe do mer in Brazil (76). The Mahoe of Trinidad is Sterculia caribaea. R. Br.

Sources of Supply. The West Indies, Jamaica, and tropical America generally. This wood is easily mistaken for that of H. tiliaceus, which is however lighter and less compact. The confusion is increased by the similarity of names and synonyms. The word "Mahoe" meaning mallow (compare French "mauve") is very wide-spread and is applied to many Malvaceous plants both herbaceous and woody.

Physical Characters. Weight, $44\frac{1}{2}$–$49\frac{1}{4}$ lb. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell faintly aromatic, peppery when worked, giving rise to sneezing. Taste faint, if any. Burns well, highly inflammable: no smell: embers glow in still air. Solution with water olive-green.

Grain. Moderately coarse and open. Surface lustrous: the rays and pores shining, the ground bright.

Bark. Has the appearance of cracked glue or shellac : " pretty smooth " (64).

Uses, etc. Gunstocks, carriage-poles, ships'-knees, fishing-rods. Very flexible. " Does not corrode nails " (64), but apparently from a remark of J. Leman's becomes " purplish when cut with iron." " Has all the characters of the best European Ash, but is more durable and longer in the fibre " (131).

Authorities. Boulger (12), p. 436. Miers (76). J. Leman (64). Schomburgk (105). Wiesner (131), Lief. 6, p. 110.

Colour. Brown brownish-grey with an occasional cast or shade of dark blue. " Dark olive " (64). Sap-wood about ¾ inch wide, whitish, écru.

Anatomical Characters. Transverse section :—

Pores. Visible : size 2, coarsish : little variation : uniformly scattered : few, 10–20 per sq. mm. : single or in compact, subdivided groups of as many as 10 : no resin : round or oval.

Rays. On the limit of vision : size, 5 fine : uniform in size and equidistant : few, about 47 per mm. : weak, running round the pores : slightly denser than the ground-tissue.

Rings. Not traceable.

Soft-tissue. Abundant in thick patches consisting of radial rows of wide-meshed cells near the pores.

Pith. ?

Radial Section. The blue stain when present is more prominent in this section. The pores are readily visible, empty, shining lines of medium coarseness. The rays are readily visible but not conspicuous, bright, bluish-brown flakes (upon a cleft surface).

Tangential Section. The rays appear as fine lines (upon the limit of vision about 5 mm. high, otherwise as the Radial section.

No. 10. THE PORTIA TREE. Thespesia populnea. Coir.

PLATE I. FIG. 7.

Natural Order. Malvaceæ.

Synonym. Hibiscus populneus. Willd.

Sources of Supply. India, Burmah and the Andamans (37). Ceylon. Trop. Africa.

Alternative Names. Native rosewood in the Carolines (22). Tulip Tree in India and many others in the various dialects, see Gamble and Watt. Umbrella tree : Faux Bois de Rose : Bois de Rose de l'Oceanie (131). Rosewood of the Seychelles (12). Poplar : Poppy Tree in Barbadoes (8).

Physical Characters, etc. Recorded dry-weight, 48–53 lbs. per cu. ft. Hardness Grade 4, compare Maple. Smell none.

PLATE II.

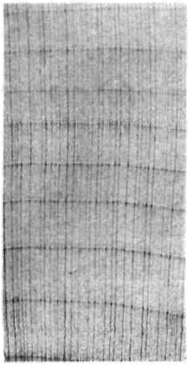


Fig. 10.
Tilia (Lime).

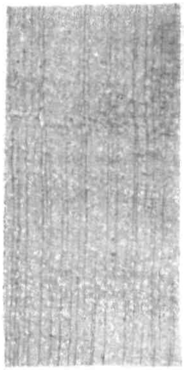


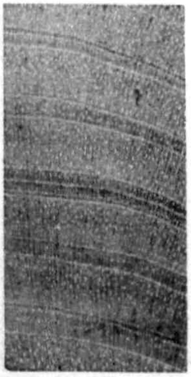
Fig. 11.
Elæocarpus Kirtoni.

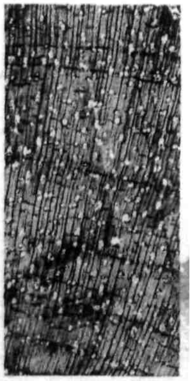
Fig. 12.
Elæocarpus dentatus.

Fig. 13.
Berrya.

Fig. 14.
Guaiacum
(Lignum Vitæ).

Fig. 15.
Citrus (Orange).





Taste astringent. "Smells of roses when rubbed" (131). Burns badly with a spurting flame: some juice expelled by the heat: embers glow in still air: much ash. Solution with cold water the colour of the wood: with hot, a dark vinous red: more afterwards extracted by alcohol.

Grain. Fine but open for the most part. Surface bright.

Bark. ?

Uses, etc. "Bowls, clubs, paddles, and carved work in the Carolines" (22). "Gunstocks, boats, cart and carriage making, furniture in India: a moderate-sized tree" (37).

Authorities. Watt (127). Christian (22). Gamble (37), p. 43. Wiesner (131). L. 6, p. 110. Barham (8).

Colour. Heart-wood deep chocolate-brown, uniform, sharply defined from the whitish or écru sap-wood. (According to Wiesner H. is dark red and S. light red (131.)

Anatomical Characters. Transverse section:—

Pores. Readily visible on account of their numbers and lighter colour: not prominent, size 4, a slight regular reduction in size in the later wood of the ring: evenly scattered. Few, 3–24 per sq. mm.: mostly single but many pairs and an occasional radial or nested group of 3 or 4: round when single: often filled.

Rays. Just visible, size 5, uniform: rather irregularly spaced a pore-width or more apart, weak, straggling: many, 8–12 per mm.

Rings. Clear with the unaided eye but no actual boundary *line*; probably indicated by the porous and laxer zones.

Soft-tissue neatly encircling the Pores when isolated becoming patchy when crowded: possibly also extremely fine cross-bars at right angles to the rays.

Pith. ?

Radial Section. Pores fine but readily visible, shining when empty, but often filled with amber, ruby and black contents. Rays difficult to see, just perceptible in certain lights.

Ground-tissue with many single cells with dark contents.

Tangential Section as the Radial, but the rays can only be seen in a transparent section.

Type specimen authenticated by the Forest Officer to the Government of Ceylon, from a log sent to the Indian and Colonial Exhibition.

No. 11. BASSWOOD. Tilia americana. Linn.

PLATE II. FIG. 10.

Natural Order. Tiliaceæ.

Alternative Names. Willow in the U.S.A. (109). Lime Tree: Linden or Lin: Bee Tree in U.S.A. (49).

Sources of Supply. North America. United States, Canada, New Brunswick.

Physical Characters, etc. Recorded dry-weight 26–45½ lbs. per cu. ft. Hardness Grade 7, compare English Birch. Smell or taste none. Burns well with a quiet, steady flame : embers glow brightly in still air : ash white. Solution colourless.

Grain. Very fine and even though open. Surface brilliantly lustrous in radial section.

Bark. ?

Uses, etc. "Not strong, easily worked, woodware, cheap furniture, panels and bodies for carriages, inner soles of shoes, turnery, paper-pulp" (53). "Cutting-boards—does not bias the knife in any direction" (100). "It is imported in logs from 10–20 feet long by 20–40 in diameter in the round or in boards, ⅜–2 inches thick" (109). "Attains a height of 80 ft. by 4 ft. diameter" (49).

Authorities. Hough (49), pt. I. p. 42. Sinclair (109). Sargent (100), No. 17. Robb (95). Stevenson (113).

Colour. White, écru; uniform. "Sometimes tinged with red" (49).

Anatomical Characters. Transverse section :—

Pores. Need lens, size 4, uniform except within the groups : evenly distributed, rather smaller and less noticeable in the outer edge of the ring : numerous, 150–200 per mm. : often subdivided or nested not always with tangential septa : usually pairs but often 3–6 in a group : round when single : empty.

Rays. Just visible, size 3–4, uniform : irregularly spaced : much more than a pore-width apart except between the attenuated ends of the rays : numerous, "middles" 4–5 per mm : "ends" about 20 : white.

Rings. Very inconspicuous, clear with lens : the boundary appears whiter. Contour undulating.

Soft-tissue. Narrowly encircling the pores.

Pith. ?

Radial Section. Pores very inconspicuous, dull, fine lines. Rays visible only by contrast of lustre : broadish flakes. Rings, inconspicuous but clear : the boundary is narrow but distinctly brighter.

Tangential Section as the Radial, but the rays appear as fine linear (not spindle-shaped), brown lines about 2–2½ mm. high.

Type specimens from commercial sources ; also authenticated by Hough.

No. 11a. LIME TREE (Small-leaved). Tilia cordata. Mill.

PLATE II. FIG. 10.

Synonyms. T. parvifolia, Ehrh. T. europea var. C. Linn. T. ulmifolia, Scop.

Alternative Name. Winterlinde (129).

Source of Supply. Europe generally.

Physical Characters, etc. Recorded dry-weight 29½-32¼ lbs. per cu. ft. Smell "peculiar and rather unpleasant" (113). Other characters as Tilia americana.

Bark. "Grey: remains supple for 20 or 30 years, and at that age becomes marked with long, fine fissures separated by wide intervals. When very old it resembles that of old Oaks" (169). "Reddish-brown, later black" (106).

Uses, etc. "Not very durable but works well and warps little—cuts in all directions without splitting and is little subject to the attacks of worms. Not suitable for works of construction; turnery, sabots" (69). "Better than the wood of the large-leaved Lime" (129). "Subject to the attacks of worms" (113)! It makes good pianoforte sounding-boards.

Authorities. Mathieu (69), p. 31. Nördlinger (86), vol. i., p. 63. Westermeier (129), p. 16. Weisner (131), L. 12, p. 972. Schwartz (106), p. 482. Stevenson (113), p. 104.

Colour. Whitish, reddish or pale-yellow. A sap-wood tree, no heart-wood. It resembles the wood of T. americana (which should be compared), but the rays are clearer and brighter. The shade or colour of the transverse section in this species is much darker than that of the Radial and Tangential sections.

Type specimens from commercial sources and also from trees known before felling.

No. 12. AUSTRALIAN WHITE BEECH. Elæocarpus Kirtoni. F.v.M.

PLATE II. FIG. 11.

Natural Order. Tiliaceæ.

Alternative Name. Kirton-wood (5).

Sources of Supply. Queensland, New South Wales.

Physical Characters, etc. Weight 32¾-46 lb. per cu. ft. Hardness Grade 7, compare Birch or Deal. Smell none, taste slightly astringent. Burns well with a rather agreeable aroma, embers glow in still air. Solution with water extremely faint, with alcohol faint brown.

Grain. Moderately fine and open. Surface lustrous, the pores usually dull, but sometimes shining: readily soils.

Bark. ?

Uses, etc. "Suitable for furniture, very easy to work" (5). This wood may possibly be confused with Birch or Sycamore but not easily with Beech.

Authorities. F. M. Bailey (5), p. 22. F. v. Mueller (80). Nilsson (85). Laslett (60), p. 254.

Colour. Brownish-white, whitish. Sap-wood. ?

Anatomical Characters. Transverse section:—

Pores. Clearly visible, yet scarcely conspicuous on account of the lack of colour: very coarse, size 1–2 · little variation: evenly distributed but occasionally gathering into pore-rings: mostly single where scattered, united into compact groups or strings of as many as 13 where crowded: few 9–13 per sq. mm: round: appear whitish in the solid.

Rays. Just visible, size 3–4: uniform but rather irregularly spaced: never less than the width of a pore apart and not avoiding them: straight: tapering: much denser than the ground-tissue: many 2–4 per mm.: light-brown.

Rings. Apparently well defined: bands of denser and more porous ground-tissue much resembling annual-rings, also some variation in the number of pores: contour regular.

Soft-tissue. The whole wood is denser and laxer by turns (in zones): the whitish lines look like soft-tissue in the solid: also narrow borders of soft-tissue encircling the pores (need micro.).

Pith. ?

Radial Section. The pores appear as coarse, open, greyish, usually dull grooves, sometimes shining when empty: the rays as very inconspicuous, faint, almost colourless flakes: the rings are not traceable, but there are bands with varying numbers of pores here and there.

Tangential Section. As the Radial, but the rays appear as minute, inconspicuous, almost colourless lines about 1 mm. high or less.

Type Specimens. No. 0577 bears the label of the Sydney Technological Museum, and No. 1381 is authenticated by Mr. F. M. Bailey.

No. 13. AUSTRALIAN MOUNTAIN ASH.
Elæocarpus grandis. F. v. M.

Natural Order. Tiliaceæ.

Alternative Names. Brisbane Quandong. Blue Fig in New South Wales. Moorgum in North Queensland (5): also Calshum (12). The popular name of "Mountain Ash" is applied also to E. longifolia in New South Wales.

Physical Characters, etc. Weight about 45½ lb. per cu. ft.

Hardness Grade 6, compare Beech. Smell and taste none. Burns well with a quiet flame : heat expels a brown gum, embers glow in still air. Solution with alcohol none, with water very faint yellow.

Grain. Moderately fine and open. Surface lustrous, the lustre being due to the ground-tissue, the rays dull, the pores sometimes shining.

Bark. ?

Uses, etc. "Building purposes, weather-boards. Reputed to have the property of resisting white ants" (5). Very fissile.

Authorities. F. M. Bailey (5), p. 23. J. F. Bailey (6), p. 393. Nilsson (85), p. 55. *Timber Trades' Journal* (120), April 20, 1901.

Colour. Grey : greyish-brown.

Anatomical Characters. Transverse section :—

Pores. Clearly visible yet scarcely conspicuous on account of the lack of colour : size 2, rather coarse : little variation : evenly distributed : pore-rings rare if ever present : rarely single pores, mostly subdivided, in compact, radial groups of from 3–8 : few, 3–20 per sq. mm. : slightly oval : some appear whitish in the solid.

Rays. Just visible, size 4 or 4–5 : uniform : irregularly spaced, never less than the width of a pore apart and not avoiding them : straight : much denser than the ground : many, 5–8 per mm.

Rings. Doubtful (see below).

Soft-tissue. White lines resembling ring-boundaries : contour well rounded : continuous : size 4 : also narrowly encircling the pores (needs micro.).

Pith. ?

Radial Section. The pores appear as dull grooves of medium coarseness. Rays, small, inconspicuous yet readily visible flakes : cells very coarse and visible with the lens : dull. The rings are not traceable.

Tangential Section. The rays appear as minute, inconspicuous, almost colourless lines about 1 mm. high (need moistening to be seen).

Type specimen bears the label of the Sydney Technological Museum.

No. 14. HINAU. Elæocarpus dentatus. Vahl.

PLATE II. FIG. 12.

Natural Order. Tiliaceæ. *Synonym.* E. Hinau. A. Cunn.

Source of Supply. New Zealand only.

Physical Characters, etc. Recorded dry-weight 35–39¼ lb. per cu. ft. Hardness Grade 7, compare Beech. Taste or smell, none. Burns well with a long lively flame : no aroma : embers die out

and leave the carbonized wood. Solution olive-brown deepening to olive upon the addition of potash : extremely little ppt.

Grain. Very fine, dense and close. Surface dull.

Bark. Reddish-brown, $\frac{3}{8}$ to $\frac{3}{4}$ inch thick, rough but not fissured or scaly : of two layers, the inner about $\frac{5}{8}$ths of the total thickness, compact and woody : the outer brittle. "Very rough" (24).

Uses, etc. "Supple, tough,—cart-wheels, shafts, ships' timbers,—not plentiful and generally small" (24). "Almost incombustible, very tough and durable,—a small, strong timber, used for sleepers, railings, etc., in exposed places" (60). "Apt to split" (3). Works almost as easily as English Beech : when planed the grain "picks up" badly in one direction.

Authorities. Laslett (60), p. 311. Smith (3), p. 212. Kew Guide (57), p. 76. Collinson (24).

Colour. Heart-wood, brown, sharply defined from the sapwood. "White" (111). "Light, dull brown" (57).

Anatomical Characters. Quite different to those of E. Kirtoni and E. grandis. Transverse section :—

Pores. Need lens, size 3–4, considerable variation : in short, radial, subdivided groups of 2 to 8 between the rays : widely scattered : few, 3 to 20 per sq. mm.

Rays. Just visible : broad in the middle and tapering to fine ends : "middles" size 4–5 and 2–3 per mm., together with "ends" about 10 per mm. The rays occupy more than half of the transverse surface. Slightly lighter in shade and denser than the ground-tissue.

Rings. Doubtful ; there is an occasional zone rather poorer in pores but no definite boundary.

Soft-tissue. None.

Pith. ?

Radial Section. Pores, fine scratches. Rays, fine lines, just visible more by contrast of lustre than of colour. Rings, scarcely indicated if at all.

Tangential Section. As the Radial, but the rays are minute, colourless, spindle-shaped lines rather broad for their length and about 1-2 mm. high.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 15. TRINCOMALI WOOD. Berria Ammonilla. Roxb. (not Klein).

PLATE II. FIG. 13.

Natural Order. Tiliaceæ.

Synonyms. B. mollis. Wall. Berrya. Gamble.

TRINCOMALI WOOD

Alternative Names. Halmillilla in Ceylon: Petwoon in Burmah (37). Katamanakku in Ceylon (12).

Sources of Supply. South India, Ceylon and Burmah (37). East Indies (131).

Physical Characters, etc. Weight 48–65 lb. per cu. ft. Hardness Grade 3, very hard, compare Blackthorn. Smell and taste none. Burns with a lively, crackling flame: embers glow in still air: ash pure white. Solution with water or alcohol colourless.

Grain. Very fine, dense and even. Surface lustrous, the brightness being due to the ground tissue and the shining drops: feels slightly damp even when really dry: does not soil easily.

Bark. "Thin" (37).

Uses, etc. "Masula-boats, spear-handles: is considered a valuable building timber in Ceylon. A large tree" (37). Fissile, works very sweetly, finishes well, is of good appearance, splits easily, straight and cleanly. I have not heard of this wood being sold in England, but it is one that deserves attention from its many excellent qualities. "Tough, elastic" (131).

Authorities. Gamble (37), p. 52. Watt (127), vol. i. p. 448. Balfour (7). Wiesner (131), i. 6. p. 108.

Colour. Light to dark red, quite uniform: the heart-wood well defined from the light yellow or brown sap-wood which is about 1 inch wide.

Anatomical Characters. Transverse section:—

Pores. Visible clearly without lens: Medium, size 3: variable: evenly distributed, often in short, subdivided, radial lines consisting of a large pore followed by others gradually decreasing in size: 5–8 groups or 60–80 pores per sq. mm.: often containing resin or gum.

Rays. Scarcely visible: fine, size 5: nearly straight: long and not often tapering: uniform in breadth: very slightly denser than the ground-tissue: very numerous, 7–12 per mm.

Rings. Apparently distinct, but cannot be located with the lens (see below): lightly undulating in contour: some variation in shade from zone to zone.

Soft-tissue. Abundant in concentric, interrupted lines almost as fine as the rays: linking the pores which are also encircled by soft-tissue of the *same* nature.

Radial Section. The pores appear as fine scratches filled with brown "Thyloses" (see p. xvii.): the rays as minute, inconspicuous, brown flakes: the rings are indistinguishable: the soft-tissue requires the lens and forms a net-work over the whole surface in close parallel lines at right angles to the direction of the pores.

Tangential Section. As the Radial, but the rays appear as minute, very obscure, brown lines about 0·5 mm. high.

Type specimen. Authenticated by the Forest Officer to the Government of Ceylon. This description differs from that of Gamble in respect to the rays, which are stated by him to be prominent.

No. 16. LIGNUM-VITÆ. Guaiacum officinale. Linn.

PLATE II. FIG. 14.

Natural Order. Zygophyllaceæ.

Synonym. G. bijugum. Stokes.

Alternative Names. Guaiacum-wood. Bois Saint, Gaillard Franc, Guayacan in Barbadoes (52).

Sources of Supply. Tropical America. West Indies.

Physical Characters, etc. Dry-weight 72½–83 lb. per cu. ft. Even the bark will sink like stone in water. Splits with very great difficulty and rough fracture. Hardness Grade 1, excessively hard. Smell and taste none. Burns extremely well with a quiet and rather smoky flame, heat expels a red gum, embers glow in still air and consume very slowly to the ash. Solution with water bright yellow; with alcohol brownish-yellow. Commercial form, small logs with sap-wood and bark about 6–12 long if under 22 ins. diam., if larger from 5–6 ft long.

Grain. Very fine, close and even. Twisted (see the surface of the log under the bark). Surface dull, smooth, cold to the touch when freshly cut, rapidly becoming sticky with green gum, when it feels like steatite.

Bark ⅛–$\frac{3}{16}$ inch thick, smooth, leathery in appearance, hard, heavy: the outermost layer brown, brittle, readily flaking off, thus exposing the dark green second layer: beneath this a third brown or white layer: no fissures: light brown or yellow in section.

Uses, etc. Pulley-blocks, rollers, handles, policemen's batons; also employed in medicine.

Authorities. Nördlinger (2), vol. vi, p. 25. Schomburgk (52).

Anatomical Characters. Transverse section :—

Colour. Dark-brown streaked with black, usually soon obscured by sticky, green resin. Sap-wood not more than about ¾ inch wide: yellow, sharply defined from the dark heart-wood.

Pores. Just visible, size 3: variable and a few smaller in the later wood: chiefly in the pore-zone, scarce elsewhere: 16-43 per sq. mm.: single or in groups of two to three pores: scattered: slightly oval: green in the inner rings of the sap-wood, near the heart: shining.

Rays. Require lens: very fine, size 6, uniform and equidistant:

long, undulating : less dense than the ground-tissue, difficult to see in a transparent section : very numerous, 19–23 per mm. a pore-width or less apart.

Rings. Usually clear on account of a pore-zone of rather larger and more numerous pores.

Soft-tissue. Doubtful, only isolated cells in the neighbourhood of the pores.

Pith. ?

Radial Section. Rather lighter in shade than the above. Pores conspicuous in the sap-wood adjoining the heart : fine green lines, always full of resin : also some with red resin. Rays require the lens, fine, under 0·5 mm. high. Rings appear as indefinite bands of colour. In tangential section the rays are imperceptible with the lens.

Type specimens from commerical sources checked by specimens in the Museum, Kew.

No. 17. MARACAIBO LIGNUM-VITÆ Guaiacum arboreum. DC.

Natural Order. Zygophylleæ.

Alternative Names. Maracaibo. Guaiacan, Guayaca, Guayacan in the Amazonas region and Palo Santo in Para (76).

Source of Supply. Brazil.

Physical Characters, etc. Dry weight about 69 lb. per cu. ft. Splits with very great difficulty and with rough fracture. Hardness Grade 1, the hardest of all woods except its near allies. Smell and taste none. Burns extremely well with a quiet flame, heat expels a yellow resin, embers glow in still air, but consume very slowly. Solution with water none, with alcohol faint yellow. Commercial form, round logs up to 60–70 feet long by 1–2 feet diam.

Grain. Very fine, close and even, the pores make a feathery pattern upon the surface. Surface dull with shining pores when freshly cut, afterwards becoming covered with a bluish-grey exudation which is *dry* not sticky : scarcely cold to the touch.

Bark. ?

Uses, etc. The same as other species of Guaiacum (which see). Easily confused with No. 16, with which it has much in common, but there is considerable difference in the structure.

Authority. Miers (76).

Colour of the heart-wood brown. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. The groups are readily visible, but the individual pores require the lens : size 5–6, quite uniform : very regularly dis-

tributed in radial, straggling, branched groups of as many as 76 pores in a group, rarely solitary or few in a group: numerous, 30–80 per sq. mm.: appear white in the solid wood: no green but often red resin, which shines after being moistened: round in shape.

Rays readily visible with the lens: size 5–6, uniform and equidistant: very slightly undulating: long: slightly denser than the ground-tissue: numerous, 11–14 per mm.: the width of a pore or less apart.

Rings clear through a line of contrast, rather variable and not always reliable.

Soft-tissue. None.

Pith. ?

Radial Section. A little lighter in shade than the above section. Pores readily visible as shallow, empty grooves: when covered with blue-grey deposit they become conspicuous as alternately converging and diverging, feathery bands. The rays require the lens, and are about ·05 mm. high. The rings are not traceable, but the bands of pores running "cross-grained" are very marked.

Tangential Section. The rays are practically imperceptible with the lens.

Type specimens from commercial sources checked by those in the Museum No. 1, Kew.

No. 18. BAHAMA LIGNUM-VITÆ. Guaiacum sanctum. Linn.

PLATE II. FIG. 14.

Natural Order. Zygophyllaceæ.

Synonyms. G. multijugum. Stokes. G. verticale. A. Rich.

Sources of Supply. Bahamas, Southern United States, Florida.

Alternative Names. Lignum Guaiaci (100), and also most of those applied to G. officinale, from which it is seldom distinguished.

Physical Characters, etc. Dry-weight 89 lbs.(100). Hardness Grade 1, excessively hard, flinty. Smell and taste none. Burns very well: embers glow in still air: exudes a reddish resin when heated: the bark crackles like slate when thrown upon the fire. Solution with water colourless: with alcohol faint yellow.

Grain. Fine, smooth, dense: spirally twisted. Surface cold to the touch, bright.

Bark. Rather rough with shallow fissures, about $\frac{1}{8}$ to $\frac{1}{4}$ inch thick: excessively hard and brittle. Of three layers the outermost brownish-white, readily cracking off and exposing the

second black layer. Dense and black in trans. sec., with the appearance of leather.

Uses, etc. Turnery, policemen's batons, pulley-blocks, dead eyes, "26 ft. long by 12 in. diameter" (100). Seldom so large, usually small logs or sticks a few inches in diam. only. Splits with great difficulty: very strong.

Authorities. Sargent (100). No. 20. Wiesner (131), L. 12, p. 950.

Anatomical Characters. As G. officinale with slight variations.

Colour. Dark-brown heart-wood sharply defined from the yellow sap-wood, which is *from* 1–1½ *inches wide.*

Anatomical Characters. Transverse section:—

Pores. Just visible, medium, size 3, variable, a few smaller in the later wood of the ring: scarce except in the pore-zone, 16–43 per sq. mm.: single or in groups of 2 or 3 pores: scattered: green in all rings *except the few outermost in the Sap-wood:* shine after wetting.

Rays. Need lens, difficult to see, very fine, size 6, uniform: equidistant, a pore-width or less apart: very numerous, about 43 per mm.

Rings. Usually clear on account of the pore-ring or the rather larger and more numerous pores of some zones.

Soft-tissue. Doubtful: some isolated cells in the neighbourhood of the pores.

Pith. Round, about 1 mm. diam., brown, hard.

Radial Section. Lighter in colour than the transverse section, pores prominent though fine, bluish-green or brown lines the contents of which reflect the light. Rays, scarcely perceptible with lens: excessively fine lines. Rings not traceable (Fig. 183).

Tangential Section. As the Radial, but the pores are more prominent, as they are exposed in greater numbers, and the rays are quite imperceptible with lens.

Type specimens from commercial sources. Not authenticated, but checked by the specimens in the Museum No. 1, Kew.

No. 19. ORANGE-WOOD. Citrus Aurantium. Linn.

PLATE II. FIG 15.

Natural Order. Rutaceæ.

Synonyms. There are seventeen enumerated in the Index Kewensis, none of which are of interest here.

Sources of Supply. Southern Europe, Asia, America, Africa, and most places with a tropical or sub-tropical climate.

Alternative Names. Laranjeira doce in Brazil (76). Djeroeh

djepan hitjiel: Djeroeh Bunten: Djerook djepan sedang: Djeroeh hetjiel: Djeroeh besaar: Djerook ragie: Limon manie in North Java (123). China Orange in Barbadoes.

Physical Characters, etc. Weight about 58 lbs. per cu. ft. Hardness Grade 2, extremely hard, compare Boxwood. Smell and taste none. Burns well with a lively flame, embers glow in still air. Solution with water or alcohol colourless.

Grain. Very fine, dense and even. Surface beautifully smooth and lustrous, the lustre being due to the ground-tissue: does not readily soil.

Bark. Very thin, strongly adherent, smooth, green streaked with black.

Uses. Turnery, cabinet making: a wood of great beauty: splits readily and cleanly.

Authorities. Nördlinger (86), vol. 4, p. 12. Hough (49), part V (25). Barham (8). Saldanha da Gama (99). Usually confused with Lemon-wood, from which it is scarcely distinguishable: also with Brazilian Yellow-wood.

Colour. Lemon or Citron colour. Sap-wood the same, not defined from the heart-wood. Quite uniform.

Anatomical Characters. Transverse section:—

Pores. Need lens, rather fine, size 4, rather variable: in radial (rarely nestlike) groups of 1–2, or occasionally 3–4: few 10–30 per sq. mm.

Rays. Need lens, medium, size 4, uniform: long but often tapering; equidistant, a pore-width or less apart: lightly undulating: white: less dense than the ground-tissue: very numerous, 6–9 per mm.

Rings. Obscure, only to be made out where a rather darker Autumn zone adjoins a spongier Spring zone: contour well-rounded.

Soft-tissue. Many concentric, narrow, white lines sometimes making the full circuit of the ring: breadth about equal to Grade 3 (Ray-scale), or rather broader than the rays themselves: contour rounded, or at times waved. Also encircling and connecting the pores here and there.

Pith. ?

Radial Section. The pores appear as very fine, dull lines: the rings are not traceable with the naked eye. The rays are white.

Tangential Section. As the Radial, but the rays are extremely minute lines, scarcely ·25 mm. high.

Type specimen authenticated by Romeyn B. Hough.

No. 20. LEMON-WOOD. Citrus medica. var. Limonum.

PLATE II. FIG 15.

Alternative Names. Citronnier : Lime-tree : Limon : Limoeiro in Brazil (99).

Natural Order. Rutaceæ.

Synonyms. C. limonum. Risso, and many others chiefly relating to cultivated varieties (see *Index Kewensis*).

Physical Characters, etc. My specimen weighs 50 lbs. per cu. ft. Hardness Grade 7, firm : Surface scarcely lustrous, otherwise as the preceding species in all particulars.

Authorities. Nördlinger (86), vol. ii. p. 14. Hough (49), part V, p. 27.

Colour. Lemon or Citron colour, fading to white in the sap-wood which is not defined from the heart-wood.

Anatomical Characters. Transverse section :—

Pores. Rather more crowded in the Spring zone of the ring : 20–60 per sq. mm.

Rays. Very numerous, 8–10 per mm.

Vertical Sections. Pores more often bright lines : Rings rather more readily visible by means of the bands of pores here and there : Soft-tissue fine but clear vertical lines which are horizontal and wavy lines in the Tangential Section. Otherwise the description of C. Aurantium serves in every respect.

No. 21. SATIN-WOOD (West Indian). Zanthoxylum sp. (Probably Z. flavum. Vahl.)

PLATE II. FIG 16.

Natural Order. Rutaceæ.

Synonyms. Xanthoxylon. Fagara flava. Krüg.

Alternative Names. Jamaica, Bermuda, Bahama or St. Domingo Satin-wood. These names may represent different varieties. Yellow-wood in the Bahamas (131).

Sources of Supply. West Indies. Chiefly from Nassau and New Providence (111).

Physical Characters, etc. Recorded dry-weight 51–68½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell like that of Cocoa-nut oil. Taste similar but offensive. Solution with water slightly yellowish : gives off a greasy smell as above. Burns well and quietly : the heat expels a copious red juice : embers glow in still air.

Grain. Very close, dense, even, and smooth like Boxwood. Surface of the ground-tissue bright : little or no "fire."

Bark. Light-grey, yellow or brown with numerous small shallow fissures: two layers; about ⅛ inch thick.

Uses, etc. Turnery, brush-backs, etc. May be met with in round logs with bark up to 12 inches in diameter. Splits raggedly and with difficulty.

Authorities. J. Smith (111). Wiesner (131). Lief. 12, p. 952. Difficult to distinguish from the Ceylon Satin-woods except by the smell (*see* note to Chloroxylon Swietenia. No. 26.)

Colour. Yellow to brown: the sap-wood lighter and greyer.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 4–5, not much variation: evenly distributed, though there are zones poor in pores here and there: numerous, 18–160 per mm.: single or in loosely-connected radial groups of sometimes as many as 16, but usually not more than 5: not subdivided: no red resin.

Rays. Just visible, size 4–6: undulating rather regularly, but not avoiding the pores: a pore-width or much more apart: numerous, 6–10 per mm.: equidistant: uniform in width: lighter in colour: unusually long.

Rings. Very clear in the solid, but not so in the transparent section: a few fine concentric lines occasionally equalling or a little broader than the rays.

Soft-tissue. Abundant in concentric fine lines, size 7 (Ray-scale), also narrowly encircling the pores.

Pith. Round or angular, 1·3 mm. diameter: rather softer than the wood: light yellow to grey: cells contain many drops of brown resin.

Radial Section. The pores need lens, being fine, dull lines: the rays are visible in certain lights, and are narrow, dull flakes: the rings appear as inconspicuous lines: *no crimson gum-veins.*

Tangential Section. As the Radial, but the rays are minute lines about 0·25 mm. high and the Rings appear as inconspicuous loops.

Type specimens from commercial sources. Not authenticated, but the wood undoubtedly belongs to the Rutaceæ, and is in close agreement with several other species of Zanthoxylum which I have examined. The structure of the whole Order Rutaceæ is very uniform.

No. 22. KNOBTHORN. Zanthoxylum capense. Harv.

PLATE II. FIG. 16.

Natural Order. Rutaceæ.

Synonyms. Fagarastrum capense. D. Don. Xanthoxylon capense. Harv.

KNOBTHORN

Alternative Name. Knob-hout.

Physical Characters, etc. Recorded dry-weight 44¾–48½ lbs. per cu. ft. Hardness, Grade 7, compare English Alder. Smell and taste none. Burns moderately well with a noisy, crackling flame and a rather pleasant aroma : embers glow in still air.

Grain. Very fine and compact. Surface brilliant.

Bark. Light brown, about ⅛ inch thick, covered with lighter-coloured papillæ (lenticels) and also having prominent, corky excrescences, hence the popular name. Closely adherent and compact. There is a lentical upon the apex of each of the "knobs."

Uses, etc. "Timber 10–12 inches in diameter, heavy, close-grained and hard . . . axles, yokes, tools, etc." (19).

Authorities. Charpentier (21), p. 136. Nördlinger (86), vol. vii. p. 53. Cape Land Almanac (19).

Colour. Heart-wood excentric, brown, well defined from the greenish-yellow sap-wood which is about 2–3 inches wide. "Greenish-yellow" (86).

Anatomical Characters. Transverse section :—

Pores. Need lens, size 3–4, very uniform : evenly scattered throughout the ring : single or in short radial groups of 2–4, closely pressed between the rays : few 15–30 per mm.

Rays. Just visible to good sight size ; 5–6, uniform : tapering to fine ends : weak, slightly avoiding the pores : 7–11 per mm. rather less than a pore-width apart : of lighter colour than the ground-tissue.

Rings. Clear : the boundary a very fine, light-coloured line of regular contour. The much more prominent smoky zones of irregular contour must not be taken to be the boundaries, as they are quite independent of the structure.

Soft-tissue. Very narrowly encircling the pores and may be overlooked : perhaps also the boundary lines.

Pith. ?

Radial Section. Pores very fine, shining scratches. Rays just visible as narrow lines upon a cleft surface by contrast of lustre. The pigment-zones are clear but less prominent and the true boundary clearer than in the transverse section.

Tangential Section. As the Radial, but the rays need lens and are fine, clearly-cut lines about 0.5 mm. high. The true boundary is even prominent in this section as yellowish or brown loops and lines.

Type, specimen authenticated by the Forest Officer to the Government at Natal.

No. 23. WILD CHESTNUT. Calodendrum capense. Thb.

PLATE XVIII. FIG. 156.

Natural Order. Rutaceæ.

Synonym. Calodendron capense ?

Alternative Names. Kastanie (57). Kaapje Kastanje (51).

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 35¾–44¾ lbs. per cu. ft. Hardness Grade 7, compare Deal. Taste or smell none. Burns well, ignites readily : a brown juice expelled by heat : a faint agreeable aroma : embers glow in still air. Solution colourless : a white ppt with potash. Bark smooth, about ¼ inch thick, greenish-brown, woody : of one layer. In transverse section masses of ray-like strands run outwards in a zigzag manner.

Grain. Very fine and even. Surface brilliant but becomes discoloured upon exposure to the air.

Uses, etc. " Tough and strong . . . useful for waggon-work . . . said to be suitable for sleepers but condemned as inferior by some authorities " (60). " A tree 60–70 ft. high by 4–5 ft. in diameter . . . tough . . . hoops for waggon-tents, yokes, etc." (57). Saws very easily, planes easily and smoothly : a wood of very compact texture.

Authorities. Laslett (60), p. 304. Kew Guide (51), p. 33. Nördlinger (86), p. 59, vol. 7. vii.

Colour. " Dirty reddish " (86). Dirty-white : uniform. A sap-wood tree apparently as my specimen is 13 inches in diameter and is all sap.

Anatomical Characters. Transverse section :—

Pores. Visible from their numbers and their arrangement in continuous, undulating lines : size 3–4, little variation : in a two-rowed pore-ring followed by undulating, continuous lines resembling those of Ulmus : few, 10–50 per mm.

Rays. Just visible, size 3, uniform though apparently of two sizes, tapering rapidly both ends to fine threads : many, 3–7 per mm., more than a pore-width apart : of lighter colour and laxer than the ground.

Rings. Clear : the boundary is the pore-ring : contour regular.

Soft-tissue. Encircling, imbedding and often connecting the pores into the wavy lines.

Pith. " Hanfkorngross, cylindrical, yellowish " (86).

Radial Section. Pores, fine scratches : need lens. Rays vaguely indicated. Rings visible by contrast of lustre.

Tangential Section as the Radial, but the rays need lens, are

rather broad for their height and are difficult to see except under the bark. The rings are clear but not prominent, fringed loops.

Type. Specimen authenticated by the Forest Officer to Government of Natal.

No. 24. SIMARUBA. Simaruba amara. Aubl.

(Not of Hayne.)

Natural Order. Simarubeæ.

Synonyms. S. officinalis, D.C. (not Macfad). Picraena officinalis. Lindl. Quassia Simaruba. Linn.

Alternative Names. Acajou blanc in Guadeloupe (131). Simarupa. Bitterwood. Bitteresche. Bitterash. Mountain Damson: Bitter Damson: Stavewood, in Jamaica (64). Pao Pomba: Aruba: Maruba, in British Guiana and the Amazonas region (76). Not the Marupa or Simaruba of Para (76).

Sources of Supply. Brazil, West Indies, British Guiana.

Physical Characters, etc. Weight about 30 lbs. per cu. ft. Hardness Grade 8, compare White Pine (P. Strobus). Smell none. Taste very bitter but not in every specimen and not nearly so intense as that of Quassia. Solution with water or alcohol colourless.

Grain. Moderately coarse and open. Surface lustrous: the Rays and ground bright, the pores dull.

Bark. ?

Uses, etc. Weakly medicinal. Of little use in Europe except for purposes where its whiteness makes it of value. "Works of construction in Brazil" (76). "Splits seriously in seasoning" (60). Easily mistaken for Quassia.

Authorities. Boulger (12), pp. 439, 440, 438 (cited under three different synonyms). J. Smith (111), p. 342. Laslett (60), p. 288. Kew Cat. (57), p. 41. Miers (76). Leman (64), p. 149. Wiesner (131), L. 6, p. 93.

Colour. Milk-white or écru. A sap-wood tree.

Anatomical Characters. Transverse section:—

Pores. Clear from their size, very coarse, size O, little variation: evenly distributed: few, 1–16 per mm.: sub-divided, mostly pairs, many threes and even groups of as many as 23 (rarely) in compact irregular clusters: short oval: no contents.

Rays. Just visible, fine, size 4, uniform: equidistant, rather less than the width of a large pore apart: avoiding the pores: rather numerous, 5–6 per mm.: denser than the ground-tissue though lax: white.

Rings. One-rowed bands of small pores or large cells loosely

collected at wide intervals, probably the boundaries: they appear as fine, well-rounded, concentric, white lines.

Ground-tissue. Very spongy and coarse, the cells being as large as those of many Conifers, equal to size 4 (pore-scale): very uniform and in radial rows.

Soft-tissue. Abundant in the form of concentric fragments winging and often linking the pores: white: size about 5 (ray-scale): as dense as the ground and imperceptible in a transparent section though visible with care in the solid: *absent throughout large areas.*

Pith. ?

Radial section. Whiter than the transverse section. Pores prominent: brownish, rather coarse and dull. Rays very fine, inconspicuous, narrow, shining flakes yet readily visible. Rings and soft-tissues not traceable.

Tangential Section. As the Radial, but the rays are just visible, extremely fine lines about ·5 mm. high: very narrow even for their size.

Type specimen authenticated by the Forest Officer to the Government of British Guiana. (Fig. 18, Pl. II, serves for this species also.)

No. 25. QUASSIA. Picraena excelsa. Lindl.

PLATE II. FIG. 18.

Natural Order. Simarubeæ.

Alternative Names. Bitter-wood. Bitter Ash. Bitteresche. (Compare also those of Simaruba). Quinquina de Cayenne (21).

Sources of Supply. West Indies, Guiana, Brazil.

Physical Characters, etc. Recorded dry-weight 33¾–34¾ lbs. per cu. ft. Hardness, Grade 8, compare White Pine (P. Strobus) and Poplar. Smell none. Taste intensely bitter. Burns well without smell: embers glow in still air. Solution with water or alcohol colourless.

Grain. Rather fine, open. Surface beautifully lustrous, the ground brilliant: the rays shining and the pores dully-shining when empty.

Bark. "Similar to that of the Common Ash" (109).

Uses. Medicinal, a bitter-tonic. Sometimes made into cups in which water is allowed to stand and become bitter. Not used for joinery in Europe. May be met with in logs from 6–10 feet long by 6–10 inches diameter. Usually confused with Simaruba, from which it is distinguishable with great difficulty.

Authorities. Gamble (37), p. 63. J. Smith (111), p. 342. Holtzapffel (48), p. 103. Sinclair (109). Charpentier (21), p. 156. Wiesner (131), L. 12, p. 95.

Colour. Milk-white : yellowish-white : Citron. A sap-wood tree.

Anatomical Characters. Transverse section :—

Pores. Plainly visible, *size* 2, little variation : scattered : few, 4–24 sq. mm. : mostly single or in compact nested or radial, sub-divided groups of 2–11 : round : empty.

Rays. Just visible, size 4, medium, uniform : equidistant, rather less than the width of a large pore apart, slightly avoiding them : rather numerous, 6–8 per mm. : much denser than the ground-tissue : white.

Rings. Doubtful : but numerous, fine, well-rounded concentric, white lines (see below).

Ground-tissue. Very spongy and coarse : cells as large as those of many Conifers : in regular, radial rows, size 7 (pore-scale).

Soft-tissue. Abundant in concentric arcs or fragments, encircling and sometimes laterally joining the pores, size about 4 (Ray-scale) : white : darker and denser than the ground : *readily visible in transparent section and also to the naked eye in the solid.*

Pith. Round with angular projections : 2–4 mm. diameter : greyish.

Radial Section. Lighter than the transverse, often with a Citron tinge.

Pores. Plainly visible with chambers 3–4 times as long as wide. Rays very fine, inconspicuous, white, narrow flakes, just visible. Rings not traceable.

Tangential Section. As the Radial, but the rays need the lens and are extremely fine lines about ·3 mm. high and broad for their length.

Type specimens from commercial sources and reputed with reason, to be this species.

No. 26. EAST INDIAN SATINWOOD. Chloroxylon Swietenia. DC.

PLATE II. FIG. 17.

Natural Order. Meliaceæ (Wiesner places it amongst the Rutaceæ).

Synonym. Swietenia Chloroxylon. Roxb.

Sources of Supply. Central and South India, Ceylon, Coromandel.

Alternative Names. Colombo, Tamil or Ceylon Satinwood. For those in the Indian vernacular see Gamble (37). "Muswal" see specimen in No. 1 Museum, Kew. Indian Yellow Wood (111).

Physical Characters, etc. Weight 49–65 lbs. per cu. ft. Hardness, Grade 2, extremely hard, compare Boxwood. Smell none when dry. Taste unpleasant. Solution with water or alcohol very faint yellow. Burns well with a lively flame; no smell: no juice expelled by heat: embers glow in still air.

Grain. Very fine, smooth, dense and even. Surface lustrous, usually satiny with much "fire" due to the ground-tissue, the pores being inconspicuous but dull.

Uses, etc. "Turnery, brush-backs, etc., in Europe: bridges, implements, furniture in India" (37). Splits with ease and with a fibrous fracture.

Authorities. Gamble (37), p. 77. Nördlinger (86), vol. xi. p. 39. Smith (111). Wiesner (131). L. 12, p. 953. Easily and usually confused with West Indian Satinwood and other species of Zanthoxylon.

Colour. Dark yellow to dark brown heart-wood gradually merging into the whitish sap-wood.

Anatomical Characters. Transverse section:—

Pores. Require lens, rather fine, size 4–5, irregularly variable: evenly distributed: numerous, 25–40 pores or pore-groups per sq. mm.: single of from 2–4 in not very compact groups: usually radially disposed but not strikingly so: often ruby resin-pores or gum-veins.

Rays. Require lens: fine, size 5–6: very long (rarely tapering ?) undulating rather regularly but not avoiding the pores, more than a pore-width apart: less dense than the ground tissue: numerous, 5–8 per mm.: equidistant and uniform in width: brownish.

Rings. Very clear though narrow. Boundary (?) a fine, clear line, the same width as the rays: contour well-rounded (see below).

Soft-tissue. Probably the boundary lines mentioned above are merely concentric zones of soft-tissue and do not indicate the year's growth. Also in neat, narrow circles round the pores.

Pith. ?

Radial Section. The pores are readily visible though very fine colourless lines, some with ruby resin or gum: the rays are readily visible but very small flakes: they show by play of light only (being dull) not by contrast of colour: the rings are very fine but not very prominent, parallel lines without contrast of colour or shade.

Tangential Section. The grain seems to run obliquely: the Rays are scarcely visible without lens as minute almost colourless lines about ·25 mm. high: the rings are rather more prominent in the lines and loops but still no contrast of colour or shade.

Type specimens authenticated by the Forest Officer to the Government of Ceylon.

The microphotograph is placed after Citrus and Zanthoxylum for the purpose of comparison.

No. 27. MARGOSE. Melia indica. Brandis.

Natural Order. Meliaceæ.

Synonyms. M. Azadirachta. Linn. Azadirachta indica. A. Juss.

Alternative Names. Maha Neem, Nym or Nim in India. For names in the various dialects of India see Gamble and Watts. The former gives 19 (22 in his last edition) and the latter 58 names. Hoop-tree in Jamaica (64).

Sources of Supply. Throughout India, Burmah, Ceylon and the Malay Archipelago.

Physical Characters, etc. Recorded dry-weight 35–49 lbs. per cu. ft. (37). Hardness Grade 2, compare Boxwood. Smell aromatic; offensive when worked. Taste astringent. Burns with a lively flame and a smell recalling Chinese Joss-sticks: embers glow in still air. Solution yellowish or faint brown.

Bark. Grey or brownish-grey: fissured: of two layers, the inner brown with many hard, white (sclerenchyma) strands: the outer darker, distinctly showing the "marking off" of the separate scales.

Uses, etc. "Furniture, equally good green or seasoned; warps and splits" (37): easily riven.

Authorities. Gamble (37), p. 69. Watt (127). Nördlinger (86), vol. vi. p. 53.

Colour. Heart-wood uniform light red not very sharply defined from the yellowish-white or écru sap-wood which is about 3½ in wide. The heart-wood darkens upon exposure.

Anatomical Characters. Transverse section :—

Pores. On the limit of vision, size 2: regularly diminishing in size and numbers towards the outer side of the ring but increasing in average size as the tree ages: mostly sub-divided in radial or nested groups of 2–4 pores: few about 9 per sq. mm.: usually with coloured contents.

Rays. Just visible, size 4–5, uniform: equidistant, less than the width of a large pore apart: rather long, tapering to great tenuity: undulating and avoiding the pores: many, about 7 per mm.: lighter in colour than the ground-tissue.

Rings. Clear if the fine lines of soft-tissue (rather broader than the rays) form the boundaries: contour regular.

Soft-tissue. Encircling the pores but not joining them except in the outer part of wide rings. As the concentric lines already

Annual ring). This latter character is even more constant than the presence or absence of a Pore-ring which may be partially dependent upon climatic conditions. I regard Gamble as the most reliable authority upon all woods embraced within his compendious work, as few authors have had the opportunity such as he for the proper authentication of his species coupled with the necessary skill and discrimination to describe them. The only conclusion I can draw therefore is that our commercial Mahoganies are not the wood of Swietenia, and in this I am supported by the want of resemblance in the structure of the specimens at Kew to our common Mahoganies.

The chief difficulty is the doubtful authenticity of specimens derived from commercial sources.

Amongst those which I have been able to examine I distinguish the following types, based chiefly upon the appearance of the rays when viewed in the solid wood under the microscope as opaque objects.

(*a*) Rays spindle-shaped in Tangential section with a few of their cells having black contents, e.g. African: Axim, Assinee, Lagos, Laguna, Oganwo and an unknown species from Lagos.

(*b*) Rays with a few of the cells having black contents but linear in shape on a Tangential section, e.g. African, Panama, Tabasco and Mexican Cedars.

(*c*) Rays medium sized, coarse-celled, no black contents, wood dense and cold to the touch, e.g. Panama, St. Domingo, City St. Domingo and Cuba Mahoganies.

(*d*) Rays of irregular height in Tangential section, no black contents, Bermuda, Honduras, and Tabasco Mahoganies.

(*e*) Rays short in proportion to their width in Tangential section, no black contents, Pores scanty in the outer part of the ring and marked by the frequency of pairs (in Transverse section) divided by the rays (i.e. not by ordinary septa), e.g. Caoba.

My specimen of the last type was one of those sent to the Paris Exhibition by the Mexican Government and passed on to me by the kindness of Sir Wm. Th. Dyer. It was marked, "Caoba: Nombre scientifico, Swietenia Mahagoni." It is interesting inasmuch as it has a character absent in the common Mahoganies which agrees partially with Gamble's description, viz. in the scantiness of the Pores in the outer part of the ring.

A precise description of the characters of the various varieties of Mahogany is at present impossible. Plate III. figs. 19, 20 and 22. The two first are taken from sections by Nördlinger.

No. 28. CAOBA. (Possibly Swietenia Mahagoni. Jacq.)

PLATE III. FIG. 21.

Natural Order. Meliaceæ.

Source of Supply. Mexico.

Alternative Name. Bois d'Acajou à Meubles.

Physical Characters, etc. Dry-weight 67 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell and taste none. Burns indifferently: embers glow in still air: some juice expelled by heat. Solution the colour of the wood. Splits easily but irregularly.

Grain. Moderately fine and even. Surface smooth and somewhat lustrous.

Bark. ?

Authority. Kew (55).

Colour. Red with dark bands and fine black lines (the pores): darkens on exposure. Sap-wood brown.

Anatomical characters. Transverse section:—

Pores. Readily visible on account of their black and white contents, size 2–3, moderate sized, uniform: thinly and irregularly scattered: many radially sub-divided, usually single but many pairs and threes, rarely many in a group: also often pairs divided by a ray: 1–16 per mm.: sometimes green contents as well as white and black.

Rays. Scarcely visible, size 5, uniform: equidistant: long, narrow, tapering at length: 5–7 per mm.: deep crimson: very sinuous in longish waves but scarcely avoiding the pores.

Rings. Fairly clear if indicated by the light-coloured lines.

Soft-tissue. In often-readily-visible continuous, numerous, concentric lines of regular contour, rather broader than the rays. They occur at irregular intervals sometimes hardly the diameter of a pore apart. Also narrowly encircling the pores (micro.).

Pith. Round, very coarse-celled, about 1½ mm. wide.

Radial Section. Pores very prominent, dark red or black lines the chief features of the wood: also an occasional white one.

Rays. Just visible, fine, red flakes.

Rings. Vague.

Soft-tissue. Just traceable as extremely fine lines.

Type specimen received from the Royal Gardens, Kew, being one of the series of Mexican Woods exhibited at the Paris Exhibition of 1900 by the Mexican Government. The specimen was marked: "Caoba: Nombre scientifico, Swietenia Mahagoni."

No. 29. PANAMA MAHOGANY. (Probably Cedrela sp.).

PLATE III. FIG. 22.

Natural Order. Meliaceæ.

To this type belong St. Domingo, City St. Domingo and Cuba Mahoganies.

Physical Characters, etc. Recorded dry-weight, 29½ lbs.–35½ : Splits unusually easily and cleanly. Hardness Grade 6, firm, compare Oak. Smell or taste none. Burns well : embers glow in still air. Solution the colour of the wood.

Grain. Smooth, very fine, and even. Surface lustrous, often "watered" or satiny.

Bark. ?

Colour. Red, brick-red, golden-red : not banded, nearly uniform. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. Conspicuous on account of their white borders. Size I, few, 1–8 per sq. mm. : appear light in the solid wood against the dark ground.

Rays. Minute, need lens, size 5, fine, uniform : long, almost too thin to taper : bright red : less dense than the ground-tissue : weak but rarely avoiding the pores : *not* sinuous in long waves. 4–7 per mm.

Rings. Clear here and there, a zone free from pores : well rounded : see Soft-tissue.

Soft-tissue. Conspicuous, fine, light-coloured lines, size 3, concentric : also encircling the pores.

Pith. ?

Radial Section. Somewhat darker than the Tangential section and considerably darker than the Transverse section. Pores, fine, glistening, cellular lines often filled with red or black resin : frequently in pairs or threes. Rays, small but a pretty silver-grain : dull : lighter than the ground. Soft-tissue, in long, fine whitish lines and prominent, hoary borders to the pores.

Tangential Section as the Radial, but the pores appear finer and the rays as minute lines upon the limit of vision. The soft-tissue, broadens out at the edges of the loops and thus gives some bands a hoary cast which is the chief feature of this wood.

In the St. Domingo variety there are signs of a loose Pore-ring indicated by the coarser fringes in Tangential section, bordering the loops.

Type specimens from commercial sources : not authenticated.

No. 30. CEDAR. Cedrela odorata. Linn. (?)

Natural Order. Meliaceæ. Not the Cedrela odorata of Blanco, Cham, Schlecht, Griseb. Ruiz, Pav, or Vell.

Alternative Names. Havannah Cedar (48). Barbadoes Bastard Cedar: Bois d'Acajou à planches, Cedre Acajou (Barbadoes): Cedro in Spanish South America (115). Cuba, Honduras or Mexican Cedar (460). Zuckerkistenholz (131). Jamaica or West Indian Cedar (111). Pfefferholz (81). Cedro aromatico: Acajou amer: Acajou femelle: Cedre in Brazil (99).

Sources of Supply. Trop. America: West Indies.

Physical Characters, etc. Recorded dry-weight 27½–39½ lbs. per cu. ft. Boulger (15) gives the specific gravity as 272-664 and the weight per cu. ft. as 31–47 lbs., which are mutually contradictory. Hardness Grade 7, compare English Birch. Smell very faint. Taste astringent rather than bitter, develops slowly upon the tongue. Burns moderately well with much crackling: embers glow in still air and consume rapidly to the white ash: no aroma. Solution pinkish, deeping upon addition of potash: copious red ppt.

Grain. Rather coarse and open. Surface slightly lustrous in radial section, but rather dull in others.

Bark. ?

Uses, etc. "Cigar boxes and similar articles, timber 12–24 inches on the side by 18–40 feet in length" (60). Laslett also gives useful mechanical tests. "Recommended for wainscoting rooms and for chests, the inside work of clothes-presses and drawers from the circumstance that vermin are not known to breed in it, shingles will last 15 years" (57). A brittle wood.

Authorities. Holzapffel (48), p. 79. Saldanha da Gama (99). Martin (68), p. 230. Smith (111), p. 101. Kew Guide (57), p. 62. Laslett (60), p. 269. Wiesner (131), L. 6, p. 94. Schomburgk (105). Boulger (15), 186.

Colour. Brownish-red: light brick-red. "Sap-wood narrow reddish-white" (15).

Anatomical Characters. Transverse section:—

Pores. Clear on account of their size, Grade 2–3: appear scarcely lighter in clean-out section: a pore-ring of a scanty row of large pores, smaller pores widely scattered with an approach to a concentric arrangement amongst them: 1–6 per mm.: contents seldom visible in this section in the solid.

Rays. Size 5–6: 4–7 per mm.: brick-red in colour.

Ring-boundaries very prominent.

Soft-tissue. In prominent, widely-separated, continuous, concentric lines very much broader than the Rays, often ½ inch apart: also vague arcs or wings to the outer pores of the ring

which with that encircling the pores is visible to good sight with the unaided eye.

Pith. Round, 1–2 mm. wide, red: many of the cells have black contents.

Vertical Sections. Pores, not much darker than the ground, rarely filled: divided into chambers which are shorter than the width of the pores. Rays, just traceable with lens when moistened.

Type specimen authenticated by Sir Thos. Hughes. The structure of this wood differs slightly from that of such cigar-boxes as I have examined and does not tally with Boulger's description (15). There is much confusion in the literature of this wood.

No. 31. TOON. Cedrela Toona. Roxb.

PLATE III. FIG. 23.

Natural Order. Meliaceæ.

Synonyms. C. australis, Roxb. C. febrifuga, Forst. C. odorata. Blanco. C. hexandra, Wall. C. serrata, Royle (Gamble separates this from C. toona).

Alternative Names. Indian Mahogany. Cèdre de Singapore (131). Moulmein Cedar in England. Red Cedar in Queensland and New South Wales; Mugurpul. Mamin at Brisbane. Woota at Wide Bay (5). Wauja in North Queensland. Woolia and Cedar in New South Wales (12). Polai. Soeren poetie in N. Java. Soerhen meira in Java and Malacca (123). Cedro vermelho in San Paulo and Rio Grande do Sul Brazil (78). For names in the Indian vernacular, consult Gamble and Watts.

Sources of Supply. India and Burmah, Queensland and New South Wales, Java, Malacca and Brazil.

Physical Characters, etc. Weight 26½–38 lbs. per cu. ft. Hardness Grade 7, soft; compare Alder or Birch. Smell and taste none. Burns well, ignites readily, little smell, embers glow in still air. Solution with cold water light brick-red, richer in colour with hot water or alcohol.

Grain. Coarse and open. Surface very lustrous, the ground tissue shining, and a great contrast to the dull rays and pores.

Uses, etc. "Cabinet-making, durable, easy to work" (5). "Furniture, door panels, carving, tea boxes, shingles, rice-pounders, dug-out canoes" (37). Very fissile; may be met with in logs of large size. "Equal to the best Mahogany" (C. Morris).

Authorities. F. M. Bailey (5), p. 32. J. F. Bailey (6), p. 394, No. 25. Laslett (60), No. 253. Nördlinger (86), vol. iv. p. 29. Miers (76). Gamble (37), p. 77. Van Eeden (123). Wiesner (131), L. vi. p. 94. Maiden (67).

Colour. Very deep red, quite uniform in all sections.

Anatomical Characters. Transverse section :—

Pores. Readily visible, size 0–1 ; no great variation except within the groups : rather unevenly distributed : a loose pore-ring of large pores : many subdivided, mostly single, but occasionally in compact, radial or nested groups of 3–7 pores : few, about 4–16 per sq. mm. : often containing red resin or gum.

Rays. Just visible, size 4–5 : uniform and equidistant : rather less than the largest pore-width apart, avoiding the larger pores : much denser than the ground : 4–7 per mm. : red.

Rings doubtful, but the ring of large pores is fairly definite here and there, but no contrast in the density of the tissue.

Soft-tissue. Abundant in fine red lines, about as wide as the rays : concentric, continuous, wavy : perhaps forming the boundary of the annual ring : also neatly and narrowly encircling the pores.

Pith. ?

Radial Section. The pores are prominent, coarse, open, chambered grooves, mostly empty, but many containing drops of dark resin or gum. The rays are readily visible, dull, darker-coloured flakes. The soft-tissue is doubtfully visible.

Tangential Section. As the Radial, but the pores are not so coarse : the pore-rings show very prominently as loops, and the soft-tissue appears as a cloudy zone upon the edge of the fringes to the loops.

Type specimens authenticated by F. M. Bailey, Forest Officer to the Government of Queensland ; also by the Forest Department at Sydney (as C. australis, Roxb.). They neither agree with Gamble's description nor with that of Nördlinger, but do so with the latter's section of C. serrata, Royle, but not with Gamble's description of that species.

No. 32. CRABWOOD. Carapa guianensis. Aubl.

PLATE III. FIG. 24.

Natural Order. Meliaceæ.

Synonyms. C. latifolia, Willd. Xylocarpus carapa. Carapa guineensis, Sweet., and C. guyanensis, Oliv., are the C. procera of De Candolle, a different species from Tropical Africa.

Alternative Names. Crababalli : Caribaballi : Caraba : Carapa, etc., variously spelled. Andiroba branca in Brazil. Andiroba carapa in French Guiana. The Carib-wood of Trinidad is Campomanesia aromatica, and not the present species. [Kundi : Tallicoma in Sierra Leone (107) ? is this C. procera.].

Sources of Supply. Tropical America, chiefly British Guiana.

Physical Characters, etc. Recorded dry-weight 39¼ lb. per cu.

ft. Hardness Grade 6, compare Beech or Chestnut. Smell or taste faint or none. Burns well with a lively crackling flame: embers glow in still air: much ash. Solution yellowish or brownish.

Grain. Moderately coarse and open, but even in some sections. Surface bright in radial section, but dull in tangential section.

Bark. ?

Uses, etc. "In British Guiana for mill, and mortar-beds, ordnance, house-framing: resists shock" (60). Laslett condemns it on account of splitting during seasoning, but I had a log about 18 in. in diameter, which worked up very well. "Cabinet-making, masts and spars, bitter-cups" (78). I suspect an error here, as the wood is practically tasteless. Logs can be obtained "up to 40 to 60 ft. long, or occasionally 170 ft. by 14 to 16 in. sq., or even at times 30 to 42 in." (68 and 78).

Authorities. Nördlinger (86), vol. x. p. 46. Laslett (60), p. 278. McTurk (68), No. 34. Morris (78). Scott-Elliott and Raisin (107).

Colour. Heart-wood deep reddish brown, well defined from the yellowish or whitish sap-wood.

Anatomical Characters. Transverse section :—

Pores. Coarse, readily visible, size 2–3, little variation: increasing as the tree ages: evenly distributed, mostly subdivided into nest-like or radial groups of from 2 to 10 pores, rarely the latter: about 8 pores or groups per sq. mm., often with red or yellow contents.

Rays. Need lens, narrow, size 5, uniform: equidistant: long, but tapering rather abruptly: undulating in short waves: as dense as the ground-tissue: 3 to 5 per mm.: nearly the same colour as the rest of the wood.

Rings. Clear here and there on account of a narrow line of dense wood adjoining a broader band of spongy tissue.

Soft-tissue encircling the pores with some slight lateral extensions: plainer in the solid section when moistened.

Pith. ?

Radial Section. Considerably lighter in shade than the transverse section: pores prominent, coarse, open grooves: shining and often containing red or black drops: rays, prominent, dull flakes of much darker red: rings not traceable.

Tangential Section. About the same shade as the transverse section: pores less prominent than in the radial section, but more numerous: rays just perceptible, short, narrow brown lines about 1·0 mm. high.

Type specimens authenticated by the Forest Officer to the Government of British Guiana.

No. 33. AUSTRALIAN MAHOGANY. Dysoxylum Fraseranum. Benth.

PLATE III. FIG. 25.

Natural Order. Meliaceæ.

Synonym. Dysoxylon, Blume.

Alternative Names. Pencil Cedar in Queensland and New South Wales. Also Rosewood in the latter locality (60).

Sources of supply. Australia, Southern Queensland (86), and Northern New South Wales (12).

Physical Characters, etc. Weight about 56¼ lb. per cu. ft. Hardness Grade 7, compare English Birch. Smell something like cigar-box Cedar. Taste none. Burns well with a noisy, spluttering flame, slight tarry smell; embers glow in still air. Solution with water strong, reddish-orange; after with alcohol, the same, but thin and weak.

Grain. Medium, open. Surface bright (but dull compared with the glossy D. muelleri), the rays and soft tissue dull and inconspicuous.

Uses, etc. "Cabinet-making, shipbuilding, turnery, carving, *engraving*" (5). Possibly Bailey refers to the backing of electros by the last mentioned use, for which it would serve, but it would be most unsuitable for engraving *upon*. This tree grows to large size.

Authorities. F. M. Bailey (5), p. 30. Kew Guide (57), p. 56. Laslett (60), p. 253.

Colour. Uniform light-red.

Anatomical Characters. Transverse section :—

Pores. Just visible from their size, grade 2 : little variation except within each group : apparently increasing in size year by year : evenly distributed, mostly subdivided into radial groups of from 2 to 6 pores : few, 8–25 pores per sq. mm. : about half containing ruby or amber resin or gum : oval.

Rays. Need lens : no contrast of colour : size 5, fine : long and tapering to great tenuity : weak and avoiding the largest pore-groups : uniform and equidistant : rather less than a pore-width apart : same colour as, and denser than the ground, but a little lighter in shade : many 6–9 per mm.

Rings. Doubtful, but they may be indicated by the concentric lines of soft-tissue (see below).

Soft-tissue. Abundant in continuous concentric lines, regularly recurring, equidistant : 4–5 per mm. : size 2–3 : cells connecting the pores very coarse, size about 7 (pore-scale) : pigmented. Also some patches of radial lines without order near the pore-groups. The concentric lines sometimes touch each

other or cease abruptly, and hence are probably no indication of the ring boundaries : colour the same as the rays.

Radial Section. The pores are coarse, prominent shining grooves, often in closely adjoining parallel lines, containing drops of brilliant ruby resin or gum : the rays are inconspicuous and difficult to see : no trace of the rings : the soft-tissue is visible to good sight as faint, hoary, zigzag lines.

Tangential Section. Resembles the Radial, except that the pores are exposed singly, not in numbers side by side : the rays are minute lines readily visible with lens : about 0·75 mm. high : coarsely cellular, of one row of cells readily visible with micro. (2 inch objective) : bright red.

Type specimen authenticated by F. M. Bailey.

No. 34. RED BEAN. Dysoxylum Muelleri. Benth.

Natural Order. Meliaceae.

Synonym. Dysoxylon, Blume.

Alternative Names. Turnip wood in New South Wales and Queensland. Kedgy-kedgy and Pencil-cedar. The latter name is also applied to D. Fraseranum. Benth.

Physical Characters, etc. Recorded dry-weight 46 lb. per cu. ft. Hardness Grade 7, compare Hazel or Alder. Smell none when dry, but "like that of a Swedish turnip when fresh" (85). Taste none. Burns well with a lively flame, no smell, embers glow in still air. Solution with water faint, scarcely any ; ditto with alcohol.

Grain. Moderately coarse and open with considerable variation according to the cut. Surface very lustrous, the ground and pores shining, the rays and soft-tissue dull but inconspicuous.

Uses, etc. "Joinery, cabinet-making, cigar-boxes" (5). "Easily wrought, interior fittings in general" (85). Works well and would fill the place of any of the softer and medium quality Mahoganies. A tree "attaining a height of 100 ft. and a diameter of 4 ft." (85). Usually confused with its near relative D. Fraseranum and with Mahoganies in general.

Authorities. F. Manson Bailey (5), No. 61a, p. 30. Nilson (85), p. 53.

Colour. Deep red, quite uniform. Sap-wood ?

Anatomical Characters. As D. Fraseranum, with the following variations :—

Pores. Increasing rapidly in size as the tree ages : in groups of 2–9 pores : few from 1–15 per mm. ; often with ruby contents : shortly oval.

Rays. Size 5–6 : many.

Radial Section. Pores frequently with black drops. Rays small, inconspicuous, dull-red flakes : soft-tissue like a fine regular "machine-ruling or hatching."

Tangential Section. As the radial : the soft-tissue makes readily-visible and beautiful though inconspicuous zigzag tracery : hoary in certain lights.

Type specimens authenticated by R. F. Baker of the Sydney Technological Museum and by F. M. Bailey, Government Botanist of Queensland.

No. 35. KOHE-KOHE. Dysoxylum spectabile. Hook.

Natural Order. Meliaceæ.

Alternative Name. Redheart (A.G.).

Physical Characters, etc. Recorded dry-weight 36–39½ lb. per cu. ft. Hardness Grade 8, compare American White Pine. Taste or smell none. Burns well without aroma, embers glow dully in still air, ash light, white and filmy. Solution with water pinkish, deepens slightly upon the addition of potash, no ppt. ; extracted afterwards with alcohol the wood gives a brownish solution which is intensified by potash and a dark red ppt. is thrown down.

Grain. Very fine. Surface lustrous especially in radial section.

Bark. Bright brown with a whitish or greyish, papery, friable outer skin and many curious crater-like marks and longitudinal wrinkles : not fissured : $\frac{1}{8}$ to $\frac{3}{16}$ inch thick : 1 layer only : fibrous and laminated within.

Uses, etc. Works like deal. Splits straight. "A substitute for cedar. Cabinet-work, the domestic arts" (60).

Authorities. Laslett (61), p. 412. The Agnet-General for New Zealand (A.G.).

Colour. Heart-wood of an uniform, rosy red, gradually passing over into the brown sap-wood which is from 3 to 5 inches wide.

Anatomical Characters. As those of D. Fraseranum, with the following variations :—

Pores. Less numerous, 4 to 10 per sq. mm., size 3 : usually single.

Rays. Closer and more numerous, 10–12 per mm., size 5–6 : and rather prominent in tangential section. Little if any resin : in vertical section the pores are visible but not prominent.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 36. WHITE PEAR. Apodytes dimidiata. E. Mey.

PLATE III. FIG. 26.

Natural Order. Olacineæ.

Synonym. A. acutifolia, Hochst.

Alternative Name. Wit Peer.

Sources of Supply. South Africa, chiefly Natal.

Physical Characters, etc. Recorded dry weight 49-61½ lbs. per cu. ft. Hardness Grade 2-3 or rather harder than Blackthorn. Smell and taste none. Burns well, no smell, heat expels gum or resin. Solution with water clear, light brown.

Grain. Very fine and close. Surface dull.

Bark. Smooth, not fissured, about ⅛ inch thick, hard: lenticels extended laterally something like those of English birch.

Uses, etc. A good turner's hard-wood. Takes a moderate finish; not ornamental. Works well in all directions. Does not readily twist or warp, and planes especially well across grain (trans. sec.). Very tough.

Authorities. Unwin. I.I. Journ. No. 62, p. 40.

Colour. Greyish-brown: a sap-wood tree, no heart-wood.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 5, little variation: rather unevenly scattered: fairly numerous, 45-60 per mm.: mostly single but in groups of 2-4, radially disposed: rarely a loose pore-ring.

Rays. Need lens, size 5: apparently two sizes of rays or else the larger taper to great tenuity: lax, coarse-celled, the cells under the micro. appear in strings and equal size 7 (pore-scale), elongated radially and rectangular: the small rays or "ends," size 5-6, a pore-width apart: the larger or "middles," short, weak, but not avoiding the pores: together very numerous, from 17-19 per mm.

Rings. Clear though not prominent: boundary a line of contrast between the dense spring zone, containing many wide-meshed cells against the dense Autumn zone: occasionally a loose pore-ring.

Soft-tissue. Doubtful whether the many wide-meshed cells are the cells of the small rays or whether they are small pores or soft-tissue. Many single cells at the boundary of the spring zone.

Pith. Round, coarse celled, ¼-½ mm. diameter.

Radial Section. Pores need lens, extremely fine striations: rays small, inconspicuous flakes visible by means of their slight lustre: rings clearly marked dark and light bands, but not much contrast.

Tangential Section. As the Radial, but the rays are minute, brown spindle-shaped lines, apparently about 1·0 mm. high.

Type specimens authenticated by the Forest Officer to the Government of Natal, and also from a log sent me by the Imperial Institute.

No. 37. HOLLY. Ilex aquifolium. Linn.

PLATE III. FIG. 27.

Natural Order. Ilicineæ.

Distribution. Europe from South Norway to Turkey and the Caucasus; Western Asia.

Alternative Names. Gemeine Huelsen: Huelsdorn: Christusdorn: Stechpalme (131).

Physical Characters, etc. Recorded dry-weight 48–60 lb. per cu. ft. Hardness Grade 5, rather hard, compare Ash or Common Elm. Smell and taste none. Burns well and quietly, ignites readily, embers glow in still air. Solution with water and alcohol colourless.

Grain. Extremely fine, close and dense. Surface bright, the little lustre being due to the minute shining pores.

Bark. Thin, about $\frac{1}{16}$ inch, greenish-brown, wrinkled, smooth, not fissured: dull, but with the remains of the closely-adherent, shining epidermis.

Uses, etc. Turnery, cogs, marquetry. Takes a black stain well and then appears like ebony (69). A good turner's wood.

Authorities. Nördlinger (87), p. 522. Ditto (86), vol. iii. p. 69. Mathieu (69), p. 58. Wiesner (131), L. xii. p. 966.

Colour. White or greenish-white. A sap-wood tree, no heart.

Anatomical Characters. Transverse section:—

Pores. Need lens, extremely fine, size 7, much variation: united in nests or lines, usually 5–12, arranged radially and branched: numerous, 40–150 per sq. mm., locally abundant: a pore-ring of a few rows of not coarser pores.

Rays. Just visible, rather broad, size 3: straight, not avoiding the pores: long, tapering gently at both ends: denser than the ground-tissue; numerous, 3–5 per mm.: irregularly spaced, a pore-width or more apart: white. According to Mathieu there are two kinds of rays, but I believe that those which he took to be the smaller are merely the attenuated ends of the larger (see also Wiesner).

Rings. Clear, though not prominent: boundary a very fine line of dense Autumn wood, followed by a few-rowed pore-ring: contour well rounded.

Soft-tissue. Occasional cells in the neighbourhood of the pore-groups.

Pith. Round or lobed: 0·5–2·0 mm. diameter: greenish or brownish, and as hard as the wood.

Radial Section. The pores are extremely fine, colourless lines running in numbers side by side: the rays are colourless, inconspicuous flakes: there is no trace of the rings: the pith shows as a broad brownish strip.

Tangential Section. As the Radial, but there are rarely more than two pores exposed side by side: the rays are minute, spindle-shaped, rather darker lines readily visible with lens or even to good eyesight, in certain lights.

Type specimens from commercial sources and from trees known before felling.

No. 38. WIT-HOUT. Ilex capensis. Harv.

Natural Order. Ilicineæ.

Source of Supply. South Africa, Natal.

Alternative Names. Whitewood. The Dutch name is also applied to a species of Niehbuhria.

Physical Characters. Recorded dry-weight 38 lb. per cu. ft. Hardness Grade 7, compare English Beech. Smell or taste none. Burns well with a faint and pleasant aroma, embers glow dully in still air. Solution faint brown, no ppt. with potash.

Grain. Fine. Surface dull and smooth.

Bark. ?

Uses, etc. Of doubtful value except for firewood, although it works very easily. It warps excessively and splits badly during seasoning.

Colour. Milk-white: a sap-wood tree.

Anatomical Characters. As those of Ilex aquifolium, with the following differences:—

Pores. Size 3–4: the radial rows usually short and not exceeding 6 pores in close contact: thinly scattered, 35–50 per sq. mm.

Rays. Size 2–3: "middles" 1–3, or "middles and ends" together 7–9 per mm.: brownish. In radial section, distinct or even prominent: rather darker than the ground-tissue: in tangential section rather broad: readily visible spindle-shaped lines.

Rings. Vague: boundary an extremely indistinct line of contrast in the density of the spring and autumn zones.

Type specimen authenticated by the Forest Officer to the Government of Natal.

Pith. ?

Radial Section. Rather lighter in colour and quite uniform: pores rather coarse, but few and dull, being filled with thyloses: rays just visible as minute hoary flakes: rings not clearly traceable: soft-tissue needs lens and then appears like fine "machine-ruling or hatching."

Tangential Section. As the Radial, but the pores are still less numerous and much finer than in the radial section: rays appear as exceptionally fine white lines, one cell wide, and about 1·5 mm. high: the rings appear as inconspicuous loops with ragged, hoary fringes.

Type specimens authenticated by the Forest Officer to the Government of British Guiana.

No. 40. SAFFRAN-HOUT. Elaeodendron croceum. D.C.

PLATE IV. FIG. 29.

Natural Order. Celastrineæ.

Synonym. Cassine crocea O.K. (Boulger [15] in error).

Alternative Names. Crocus-tree: Saffron: Safforan, in South Africa. Umbomoana (20), in Zululand. Umbomvana (61).

Sources of Supply. Natal and other parts of South Africa.

Physical Characters, etc. Weight about 54 lb. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell and taste none (perhaps faintly fragrant). Solution with water a beautiful deep crimson, from good dark-coloured wood. Burns well, embers glow in still air.

Grain. Exceptionally fine and close. Surface bright.

Bark. Leathery, smooth, not fissured, hard, about ¼ inch thick, purple within, covered by an orange-coloured skin having minute lenticels.

Uses, etc. "Furniture, boat-building, waggons, wood-engraving (the coarser kinds), excellent for turnery. Tough, solid, and durable. Works well in every way" (60). "Beams, planks, furniture" (19). Easily confused with Assagai-wood ('Curtisea faginea'). No. 120.

Authorities. Nördlinger (86), vol. vii. p. 27. Laslett (60), 304. Ditto (61), 438. Cardrew (20). Cape Land Almanack (19).

Colour. Rosy red: reddish-yellow, well defined from the paler and yellower sap-wood: quite uniform.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 6, fine, little variation: evenly distributed, but collected into loose zones here and there: few, about 45 per sq. mm.: easily confused in this section with the

soft-tissue, the cells of which are nearly half the pore-diameter: mostly single, but also in groups of 2–3 pores.

Rays. Visible in certain lights: size 4, medium: nearly uniform: equidistant, a pore-width or less apart: few, about 2 per mm.: less dense than the ground-tissue: undulating, but not avoiding the pores: tapering both ends: the attenuated ends convey the impression that there are two kinds of rays, a circumstance of frequent occurrence in this order (Celastrineæ).

Rings. Not very clear: boundary, a narrow ring of pore-less Autumn wood adjoining a more porous band of Spring wood: contour rounded or undulating (80 per inch in my specimen).

Soft-tissue. Abundant in many long, radial lines of cells and also in ill-defined, gently undulating, concentric bands.

Pith. ?

Radial Section. Rather lighter in shade than the transverse. The pores need the lens and are minute shining lines: the rays are inconspicuous flakes of almost the same colour as the ground-tissue and visible in certain lights only: the rings and the soft-tissue can neither be traced with the lens.

Tangential Section. As the Radial, but unusually uniform in colour: the rays need the lens, being minute, dark-red lines about 0·5 mm. high.

Type specimens authenticated by the Forest Officer to the Government of Natal. They do not agree with Laslett's description "something like walnut," but I have checked them with specimens at Kew, the Imperial Institute and elsewhere, and with Nördlinger's section.

No. 41. SILKBARK. Celastrus acuminatus. Linn.

(Not of Rafin., or Wall.)

PLATE IV. FIG. 30.

Natural Order. Celastrineæ.

Alternative Name. Zybast (57).

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 63 lb. per cu. ft. Hardness Grade 3, compare Blackthorn. Taste or smell none. Burns well and quietly without aroma, heat expels a yellow juice, embers glow in still air and consume very slowly to the abundant white ash. Solution faint pinkish-brown, deepening to port wine colour upon the addition of potash; no ppt.

Grain. Unusually fine, compact and dense. Surface rather dull, but silky and smooth to the touch.

Bark. ?

Uses, etc. "A small tree rarely exceeding 1 ft. in diameter by 2 ft. bole. . . Furniture and fancy-work. Said to be suitable for umbrella handles" (57). A wood of firm texture; works hard; difficult to split.

Authorities. Kew Guide (57), p. 33. Nördlinger (86), vol. vii. p. 13.

Colour. A delicate brown marked with fine, close, darker lines, giving the wood the appearance of watered silk.

Anatomical Characters. As those of Elæodendron croceum, with the following differences:—

Pores. On the limit of vision with lens, size 5–6: few 10–25 per sq. mm.: easily distinguishable from the cells of the soft-tissue by their lack of colour: scattered thinly and irregularly.

Rays. Need lens, size 5: 8–10 per mm.

Rings. Very clear, though not prominent: boundary, a sharply defined band of brownish, coarse-celled soft-tissue in concentric lines of undulating (crenate) contour.

Pith. ?

Radial Section. Rays faint pink or purplish flakes on a cleft surface otherwise obscure: rings prominent, the boundaries being close, fine, brown lines.

Tangential Section. As the Radial, but the ring-boundaries are very prominent, though not broad, dark, granular bands or loops of jagged contour, making a very pretty figure.

Type specimen authenticated by the Forest Officer to the Government of Natal. This wood should be examined with a microscope.

No. 42. CANADIAN BUCKTHORN. Rhamnus Purshiana. D.C.

PLATE IV. FIG. 31.

Natural Order. Rhamnaceæ.

Alternative Names. Bearberry or wrongly Barberry (2). Sacred-bark Buckthorn: Wild Cherry: Shittim-wood: Cascara sagrada (49). Bearwood (100).

Sources of Supply. Canada and the United States.

Physical Characters, etc. Recorded dry-weight 31½–35¼ lb. per cu. ft. Hardness Grade 7, compare English Birch. Smell none. Taste not strong but rather nauseous. Burns well with puffs of vapour, heat expels a yellow juice, no particular aroma, embers glow in still air. Solution with water brownish, with alcohol ditto, giving a slight pink ppt. on the addition of potash.

Grain. Fine, dense and compact. Surface lustrous in all sections.

Bark. Of a "bluish-grey colour mottled with whitish, quite

smooth and checked longitudinally, similar to that of the Beech in the east of U.S.A." (49).

Uses, etc. "Ornamental purposes, . . . a foot in diameter, or usually smaller" (2). "Not strong" (100).

Authorities. Anderson (2), p. 14. Hough (49), pt. vii. p. 23. Sargent (100), p. 41.

Colour. "Light yellowish-brown streaked with purplish-brown and with light yellow sap-wood" (49). Heart-wood irregular in width and contour, defined but not sharply, from the sap-wood, which is from ¼ to ½ inch wide.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 4, a slight diminution in the outer side of the ring: thinly scattered, 10–25 per sq. mm.: scarce in the Autumn wood: a single-rowed pore-ring: a tendency to an oblique arrangement: in subdivided and often nested groups of 2 to 8 pores.

Rays. Fine but readily visible, size 5, uniform: long, scarcely tapering, straight but slightly bent at the ring-boundaries: a large pore-width or more apart: denser than the ground-tissue: 3–7 per mm.

Rings. Very clear on account of the clearly-cut pore-ring: contour undulating or irregularly lobed.

Soft-tissue. Narrowly and neatly encircling the pores without extensions.

Pith. ?

Radial Section. The pores appear as very fine, lustrous grooves: the rays are just visible as small, pale flakes: the ring-boundaries are inconspicuous, but well-defined by a fine clearly-cut line, and the soft-tissue is practically invisible.

Type specimens authenticated by Hough.

No. 43. JAMAICA COGWOOD. Ceanothus Chloroxylon. Nees. (?)

Natural Order. Rhamneæ.

Synonym. Zizyphus chloroxylon, W.

Alternative Name. Cerillo.

Source of Supply. West Indies.

Physical Characters, etc. Weight about 67 lb. per cu. ft. Hardness Grade 1, compare Ebony. Smell none. Taste insipid. Burns badly with much crackling, difficult to ignite, embers glow in still air. Solution with water bright brown.

Grain. Very fine, close, even. Surface lustrous: the rays, pores and ground-tissue all bright: the pores often glistening.

Bark. ?

Uses, etc. Turnery, mill-work, cogs of gear-wheels. "Very elastic" (131).

Authorities. Wiesner (131), Lief. 6, p. 106.
Easily confused with Quebracho, No. 212.
Colour. Very deep, uniform nut-brown. Sap-wood ?
Anatomical Characters. Transverse section :—
Pores. Need lens, size 3–4, medium, little variation : evenly scattered : mostly single, a few compact groups of 3–4, rarely 6–8 : from 5–50 per sq. mm. : nearly all with red or yellow contents : round : sparkling.
Rays. Need lens, size 5, fine : uniform : equidistant, the width of a pore or less apart : weak, almost straight, not avoiding the pores : tapering both ends : lax and cellular, less dense than the ground-tissue : brown or reddish : 6–8 per mm.
Rings. Doubtful (see Soft-tissue below). Occasional zones of wood poor in pores : contour regular.
Soft-tissue. Numerous fine, continuous, concentric lines resembling the ring-boundaries : with rather less space than between the rays : sometimes 3–5 per mm., but often zones where they are lacking : colour same as the rays.
Pith. ?
Radial Section. The pores are fine, dull, hoary lines with occasional drops of resin. The rays are narrow, hoary, inconspicuous yet readily visible flakes. The rings are only faintly indicated.
Tangential Section. As the Radial, but the rays are fine lines not traceable with the lens, and the loops are slightly indicated by some difference in the depth of colour of adjoining zones.
Type specimen from commercial sources, not authenticated but reputed to be C. chloroxylon. The structure resembles that of some Rhamnaceous woods.

No. 44. HORSE CHESTNUT. Æsculus hippocastanum. Linn.

PLATE IV. FIG. 32.

Natural Order. Sapindaceæ.
Synonyms. Æsculus castanea, Gilib. Æ. memmingeri, Hort. Æ. procera, Salisb.
Alternative Name. Marronier d'Inde in France (69).
Sources of Supply. Europe, British Isles, North America.
Usually confused with many other soft whitish woods.
Physical Characters, etc. Weight 29½–39 lb. per cu. ft. Hardness Grade 7, soft : compare Deal or English Birch. Smell (when fresh only) like rubbed potatoes (86). Taste none or slightly insipid. Burns badly, maintains a flame with difficulty, but the embers glow in still air. Solution with water or alcohol colourless.

Grain. Fine, close and even. Surface somewhat shining, the lustre being chiefly due to the ground tissue.

Bark. Light grey with brown lenticels : thin : smooth when young, cracking later with lattice-like fissures upon the ridges of which a black skin persists.

Uses, etc. Mathieu's opinion is that it "is one of the worst woods that one can produce either for work or for fuel : does not cut cleanly, decays rapidly, is scarcely good enough for packing-cases. Twists and warps but little" (69). "Carving and packing-cases" (131).

Authorities. Hartig (42), pp. 33–44. Schwartz (106), p. 85. Nördlinger (87), p. 510. Ditto (86), vol. iii. p. 45. Hough 49), part i. p. 47. Mathieu (69), p. 44. Wiesner (131), L. 12, p. 970.

Colour. Pure white : yellowish-white : reddish. A sap-wood tree.

Anatomical Characters. Transverse section :—

Pores. Require lens : extremely small, size 6 : uniform and evenly distributed or rather fewer in the outer Autumn zone : occasionally grouped in radial (not subdivided) lines of 2–7 pores : a tendency to branch : numerous, 100–125 per sq. mm.

Rays. Require lens : extremely fine, size 6 : lightly undulating : often tapering : not very long : very slightly denser than the ground-tissue : very numerous, about 17 per mm. : a pore-width or less apart, only the fine ends avoiding the pores.

Rings. Difficult to see in the solid wood, but very clear in a thin section : boundary, a few rows of closely-packed pores here and there adjoining a zone of Autumn wood poor in pores.

Soft-tissue in the form of scattered cells only.

Pith. 2–5 mm. thick : round edor 4-lobed : white : very soft.

Radial Section. The pores require the lens and are then only visible by means of their lustre : the rays are extremely fine colourless lines about their own height apart and visible by reflection only in a certain light : the rings are just visible as vague lines and the pith is greyish-brown and very prominent.

Tangential Section. As transverse section, but the rays appear as fine lines, about 25 mm. high, just perceptible with lens ?

Type specimens taken from a tree which was known when in leaf.

No. 45. SNEEZEWOOD. Pteroxylon utile. Eck. and Zey.

PLATE IV. FIG. 33.

Natural Order. Sapindaceæ.

Alternative Names. Nieshout : Umtati (12).

SNEEZEWOOD

Sources of Supply. South Africa: Natal, Cape Colony, Zululand.

Physical Characters, etc. Weight 65–67½ lb. per cu. ft. Hardness Grade 1, compare Ebony. Smell peppery, often excites sneezing and running of the eyes when worked. Taste nauseous and bitter. Solution with water or alcohol faint yellow. Burns well with a lively crackling flame, heat expels a sepia-coloured juice, embers glow in still air.

Grain. Extremely fine though open. Surface very lustrous, due to the ground-tissue: rays and pores dull.

Bark. ⅛–¼ inch thick, hard, shiny, coriaceous, cracked, persistent, brown without, yellow within.

Uses, etc. "Turnery, building, water-work" (19), "works of construction, bridges: but slightly affected by water" (51). "One of the most desirable woods in the world: bearings for shafts: takes a beautiful polish: termite and teredo proof: very inflammable even when green. May be met with in logs 20–30 ft. long by 2–4 ft. in diameter" (19). Hard to saw, but not refractory.

Authorities. Boulger (12), pp. 421–418. Laslett (60), p. 303. Kew Catalogue (57), p. 30. Cape Land Almanack (19).

Colour. Rose colour, light citron to brownish-red with lighter and darker zones. Sap-wood milk-white about 20 rings wide, defined from the heart. Colour darkens upon exposure.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 5–7, uniform: evenly distributed, but a slight tendency to gather into zones and a radial arrangement of the pores: rather fewer in the outer part of the rings: occasionally in radial groups of 2–7: not subdivided: round: numerous, about 50–70 per mm.: contents mostly white, sometimes dark red.

Rays. Require the microscope to count them, but just visible with lens: extremely fine, size 7: lightly undulating, not avoiding the pores: same density as the ground-tissue: white: very numerous, 20–25 per mm.: about the width of a pore apart.

Rings. Very clear: the boundary a line of contrast between the density of the ground-tissue, accompanied by a very loose pore-zone against one "poor" in pores: contour undulating.

Soft-tissue. None.

Pith. ?

Radial Section. The pores are minute lines upon the limit of vision, blood-red when filled with resin, otherwise whitish or hoary. The rays need the lens and are minute inconspicuous flakes. The rings are very clear and appear as light and dark bands, making loops as in deal.

Tangential Section. As the Radial, but the rays appear as

minute lines, which are invisible even with a microscope lens (a " Swift " 2 inch).

Type specimens authenticated by the Forest Officer to the Government of Natal.

No. 46. SYCAMORE. Acer Pseudo-Platanus. Linn.

PLATE IV. FIG. 34.

Natural Order. Sapindaceæ.

Alternative Names. Érable sycomore: Grand érable de montagne: Faux Platane in France (69). Berg-ahorn in Germany (131). This species goes by the name of Sycamore in the United States (12), but the name is more commonly applied to the Plane-tree, Platanus occidentalis, Linn.

Sources of Supply. Europe, British Isles, United States of America and Canada.

Physical Characters, etc. Weight 28¾–49 lbs. per cu. ft. Hardness Grade 4, compare Maple. Smell or taste none. Burns unusually well with quiet but lively flame, embers glow in still air. Solution with water or alcohol colourless.

Grain. Close, even and fine. Surface somewhat lustrous, especially in the radial section, where the rays are the most lustrous portion.

Bark. Smooth: ⅛ inch thick: leathery: not fissured: supple: grey: becomes scaly with age.

Uses, etc. Carpentry, especially table tops, on account of its whiteness: bobbins and other turnery. Durable when under cover, but not when exposed: splits cleanly but with difficulty. A tree of medium size, usually met with in logs as felled, with bark or in waney planks.

Authorities. Hartig (42), pp. 30–41. Schwartz (106), p. 482 and pt. I. Nördlinger (87), p. 509. Ditto (86), vol. iii. p. 41. Mathieu (69), p. 37. Laslett (60), p. 164. Stevenson (113), p. 119. Wiesner (131), L. 12, p. 969.

Colour. Milk-white: brownish: uniform. A sap-wood tree. Often streaked with green (a defect).

Anatomical Characters. Transverse section:—

Pores. Require lens, rather fine, size 4: nearly uniform in size: evenly distributed: numerous, but not crowded, 20–30 per sq. mm.: occasionally in groups of from 2–5 pores.

Rays. Require lens or just visible: medium, size 4: nearly straight, only the fine ends avoiding the pores: short, soon tapering both ends: denser than the ground-tissue: about 2½–3½ per mm. upon an average: white, with a satiny lustre.

Rings. Obscure in the solid wood: boundary, a fine, clear,

brown line of Autumn wood scarcely wider than a ray, visible with lens: contour well rounded, otherwise little contrast between the Spring and Autumn zones.

Soft-tissue. Not readily distinguishable from the ground, the whole rather wide-meshed and spongy.

Flecks. ? Possibly the green stripes above referred to are of this nature.

Pith. Some mm. thick: round: reddish or yellowish-white: "of two kinds of brownish, thick-walled cells" (86).

Radial Section. The pores are difficult to see even with lens. The rays are small lines or flakes, which are readily visible by means of their lustre, not by their colour. The ring-boundaries appear as faint, thin brown lines.

Tangential Section. As the radial, but the rays appear as fine, colourless lines about ·5 to 1·0 mm. high (need micro.).

Type specimens are from trees which were known when in leaf.

No. 47. HARD MAPLE. Acer saccharinum. Wang.

(Not Linn. nor Michx.)

PLATE IV. FIG. 34.

Natural Order. Sapindaceæ.

Synonyms. A. barbatum, Michx. A. nigrum, Michx. A. palmifolium, Borck.

NOTE.—The A. saccharinum, Michx., is the var. nigrum of this species, of Torr. et Gray. The A. saccharinum, Linn., is A. dasycarpum, Ehrh.

Alternative Names. Sugar Maple, Rock Maple, Sugar Tree (49), Bird's-eye Maple.

Sources of Supply. Canada, Nova Scotia, New Brunswick, Newfoundland and the United States.

Physical Characters, etc. Recorded dry-weight 33 (?)–54 lbs. per cu. ft. Hardness Grade 4, compare Sycamore, Hornbeam. Smell none. Taste, if any, like Deal. Burns well and quietly with a lively flame, embers glow in still air. Solution with water or alcohol colourless.

Grain. Fine, smooth, even, dense. Surface in radial section brilliantly lustrous, less so in other sections: the pores and rays being dull.

Bark. Sometimes as much as 1½ inches in thickness: of two layers, the outer deeply fissured, soft and corky, "scaling at length." The scales may be seen distinctly marked off in transverse section. These areas are not present in the inner layer, which is about ¼ inch thick, woody and exhibits the continuations of the rays.

Uses, etc. "Furniture, shoe-lasts, keels, keelsons, flooring,

turnery, interior finishing, saddle-trees" (100). "Tough, strong : one of our best woods for veneering, panelling and high-class furniture May be met with up to 110 ft. high by 4½ ft. in diameter."

Authorities. Hough (49), pt. I. p. 48. Nördlinger (86), vol. iii. p. 41. Macoun (66), p. 99. Ditto (65), p. 21. Sargent (100), No. 64. C. Robb (95).

Often confused with A. dasycarpum, Ehrh. and A. rubrum Linn., from which it is distinguishable by the breadth of the rays. Robb says : " that curly Maple is properly A. rubrum," but although that species is often curly, yet so is our present species, which, moreover, is the better known of the two.

Colour. Brown in various shades : yellowish-white : reddish-brown : ill-defined from the lighter, creamy-white sapwood.

Anatomical Characters. Transverse section :—

Pores. Need lens, rather fine, size 4–5, nearly uniform : evenly distributed, not crowded : rather numerous, 40–85 per sq. mm. : single or in groups of 2–4 pores.

Rays. Visible or even prominent in certain lights : rather broad, size 3, gently undulating, nearly straight : apparently thickened (or nodose) at the junction with the ring-boundaries (really only darkened in shade) : numerous, 2–4 per mm. : tapering to very fine ends, which are a pore-width or more apart : colour, yellow or brownish : glossy.

Rings. Clearly visible : boundary a clear, fine, brown line of Autumn wood, and a slight contrast between the Autumn and Spring wood : contour undulating.

Soft-tissue. Doubtful : patches of cells here and there. According to Nördlinger (86) there are " flame-shaped patches in the spaces between the pores." ?

Flecks. See Introduction, Plate XX. Figs. 170–1.

Pith. " One to some mm. thick, angularly-round ('eckigrund')" (86) : white or reddish.

Radial Section. Lighter in shade than the transverse section, mottled : pores difficult to trace : rays, prominent flakes, show up against the brilliant ground, being conspicuous by contrast of their lustre : ring-boundaries just traceable, fine, clearly-cut lines. Plate XXIII. Fig. 180.

Tangential Section. Very different in appearance to the other two sections : rays minute, just perceptible lines about 1 mm. high : rings in narrow, yellowish lines and loops, the chief character of this section, as the silver grain is of the radial section.

Type specimens authenticated by Hough. Also from commercial sources checked by Nördlinger's section.

No. 48. VINE MAPLE. Acer circinnatum. Pursh.

PLATE IV. FIG. 34.

Natural Order. Sapindaceæ.

Synonym. A. virgatum, Rafin.

Source of Supply. British Columbia and the United States.

Physical Characters, etc. Recorded dry-weight $41\frac{3}{4}$ lbs. per cu. ft. Hardness Grade 4, compare Hard Maple. Taste or smell none. Burns well and quietly with little aroma, embers glow in still air, heat expels a copious red juice. Solution colourless.

Grain. Fine and very compact. Surface moderately lustrous.

Bark. Brown, wrinkled externally: $\frac{1}{4}$–$\frac{3}{8}$ inch thick, of one layer finely laminated, and full of hard white bodies. A doubtful timber tree. "Small and crooked" (2). "Not strong" (100).

Authorities. Macoun (66), p. 98. Anderson (2), p. 13. Sargent (100), p. 47. Hough (49), pt. IX., p. 21.

Colour. White to brownish-white with yellow silver-grain.

Anatomical Characters. As those of A. macrophyllum, but the pores are smaller (size 4–5) and fewer (about 10–25 per sq. mm.)

Type specimens authenticated by Hough.

No. 49. BROAD-LEAVED MAPLE. Acer macrophyllum. Pursh.

PLATE IV. FIG. 34.

Natural Order. Sapindaceæ.

Alternative Names. Oregon Maple, Big-leaved Maple (49), Californian Maple (12).

Sources of Supply. Canada and the United States of America.

Physical Characters, etc. Recorded dry-weight $40\frac{1}{2}$ lbs. per cu. ft. (49), Hardness Grade 6, compare Chestnut. Taste or smell none. Burns well and quietly with little aroma, embers glow in still air, heat expels a copious red juice. Solution colourless.

Grain. Fine, dense, even and compact, though open. Surface lustrous.

Bark. "Brownish-grey, becoming fissured longitudinally with age and rough with friable scales, very much resembling the bark of A. rubrum" (49). Of two layers, each about $\frac{1}{4}$ inch thick, both finely laminated: the inner fibrous, the outer hard and leathery.

Uses, etc. "Grows to a large size on Vancouver Island: a magnificent tree" (66). "The most valuable of the deciduous trees

of the West Coast. Furniture, mantles, handles and interior finishing" (65). "One of the commonest and best of our deciduous woods (Vancouver): very straight and tall: the bird's-eye figure is very beautiful" (2). "Turned work, tool-handles and furniture" (49). "Much better than the wood of the soft Maple: much of it is curly" (65).

Authorities. Macoun (66), p. 98. Ditto (65), p. 20. Laslett (60), p. 183. J. R. Anderson (2), p. 13. Hough (49), pt. VII., p. 24. Boulger (12), p. 445. Sargent (100), p. 47.

Colour. "Reddish-brown with lighter whitish sap-wood" (49–100).

Anatomical Characters. As those of Acer saccharinum, with the following variations :—

Pores. Appear white under the lens when cut in transverse section (in the Heart-wood only).

Rays. Only just discernible to good sight: size 4, and 4–7 per mm.

Type specimens authenticated by Hough.

No. 50. TAAIBOSCH. Rhus lucida. Linn.

(Not of Ait., or E. Mey.).

Natural Order. Anacardiaceæ.

The native name is also applied to Rhus lævigata, Linn.

Physical Characters, etc. Recorded dry-weight $38\frac{3}{4}$ lbs. per cu. ft. Hardness Grade 3, compare Maple. Taste or smell none. Burns well with a faint aroma, embers glow dully in still air, much ash. Solution brown, deepening very considerably upon the addition of potash; no ppt.

Grain. Fine, compact and sinuous: surface bright.

Bark. Light brown: not very rough: of one layer, separating in very small, rounded scales: brown internally and filled with hard, white rod-like bodies.

An easy wood to work.

Authorities. Nördlinger (86), vol. iv. p. 21.

Colour. Heart-wood of irregular contour: yellowish to reddish-brown, with occasional dark bands: well defined from the light-brown: $1–1\frac{1}{2}$ inches of light brown sap-wood.

Anatomical Characters. Transverse section :—

Pores. Just visible (readily in the black zones), size 3–4, uniform: evenly scattered, rather fewer in the outer side of the ring: some single, but more subdivided pairs and threes (or more) radially disposed between the rays: a tendency to oblique rows: few, 20–40 per sq. mm.

Rays. Need lens, size 5–6, uniform: equidistant, a pore-

width apart : sometimes gently avoiding the pores : red : very many, crowded, 9–14 per mm.

Rings. Clear (prominent with lens in the black wood only) : boundary, a poreless zone and a line of contrast between the coarse ground-tissue of the inner and the dense outer wood of the ring.

Soft-tissue. Encircling the pores and in well developed rings, joining them up to oblique, wavy lines.

Pith. " Small, lobed (rund-eckig) of brownish or yellowish-red cells " (86).

Radial Section. Pores, fine scratches visible chiefly in the dark wood. Rays just visible as fine red flakes.

Tangential Section. As the Radial, but the rays need the microscope, and the rings are fairly evident especially in the dark wood.

Type specimen authenticated by the Forest Officer to the Government of Natal. Rhus does not much resemble the other genera of the same order.

No. 51. ACACIA. Robinia Pseudacacia. Linn.

PLATE IV. FIG. 36.

Natural Order. Leguminoseæ.

Synonyms. R. fragilis Salisb. Pseudacacia odorata. Moench.

Alternative Names. False Acacia. Locust. Yellow Locust : Black Locust : Red Locust in U.S. America (49). Virginische Schotendorn (68).

Sources of Supply. Europe. British Isles. North America.

Physical Characters, etc. Weight 36–52 lbs. per cu. ft. Hardness Grade 5, compare Ash, Elm. Smell and taste none when dry : "like green bean-pods when fresh felled" (87). Burns well with much crackling, embers glow in still air but soon die out. Solution with water and alcohol, olive-yellow.

Grain. Coarse, open and sinuous. Surface lustrous and satiny : the ground-tissue bright, the pores and rays dull.

Bark. Thin, ⅛–¾ inch, deeply fissured : shining when young : stringy, laminated bast within.

Uses, etc. Posts, tree-nails, ribs of vessels, turnery. In France, "chairs, furniture, joists, spokes, rungs of ladders—almost incorruptible—stronger and more durable than Oak" (78). "Elastic and of a vertical resistance one-third greater than Oak—the best wood for spokes—more valuable than Oak, Elm, or Ash"(69). "Very durable in contact with the ground —shipbuilding, posts, works of construction—preferred to all others for tree-nails" (106). NOTE.—As this tree grows as fast as the Beech, and as its timber is so valuable, it is worthy of

more attention from the planter and forester than it has received hitherto. In addition it is specially useful as a means of fixing shifting sands (69). It sometimes attains a height of 75 ft. and a diameter of 48 inches (100). The wood splits very straight, easily and smoothly.

Authorities. Nördlinger (87), p. 538 : ditto (86), vol. iii. p. 101. Sargent (100), No. 53. Hartig (42), pp. 16 and 39. Schwartz (106), p. 480, plate i. fig. 3. De Mornay (70), p. 58. Holtzapffel (48), p. 91. Hough (49), part iv. p. 21, section No. 80. Mathieu (69), p. 119. Wiesner (131), L. 12, p. 941. Martin (68), p. 226. Sometimes confused with Ash.

Colour. Yellow : greenish-yellow : yellowish-brown : brown : sharply defined from the greenish-white or yellowish sap-wood, which is about 1–7 rings wide. "Becomes intenser and more beautiful with age" (68).

Anatomical Characters. Transverse section :—

Pores. Conspicuous, coarse, size 1, rapidly diminishing in size from the Spring to Autumn wood : more numerous in the pore-ring, but evenly scattered outwards : 10–25 per sq. mm. single or in subdivided groups of as many as 10 : oval. Filled with thyloses.

Rays. Just visible : medium, size 4 : shortly tapering both ends : much waved and avoiding the pores : less than a pore-width apart : scarcely denser than the ground-tissue : numerous 6–9 per mm. : light brown.

Rings. Conspicuous : the boundary a coarse pore-ring with loose tissue following the dense Autumn wood, which is poor in pores.

Soft-tissue. Abundant between the pores of the pore-ring : also encircling the later pores and loosely connecting them into wavy, concentric lines.

Pith. Roundish five-lobed or pentagonal : the few early rings follow its outline : 2–3 mm. diam : coarse-celled : shining.

Radial Section. Pores very prominent, often several side by side, contents brown. Rays clear in certain lights ; not prominent, white flakes. Rings traceable by the pore-ring only, rather prominent in well-grown wood. Pith dark-brown, extremely soft.

Tangential Section. As the Radial, but the pores scarcely so numerous nor so coarse. Rays need the lens, fine brownish lines about 1 mm. high. Plate XXII. fig. 176.

Type specimens from commercial sources also authenticated by Hough and verified by comparison with Nördlinger's section.

of planed wood : rays difficult to see : dull minute flakes. Rings indefinite, though light zones are often apparent in light wood.

Tangential Section. As the radial, but the rays are extremely minute lines about 0·2 mm. high.

No. 53. ROSEWOOD (Brazil). Dalbergia nigra. Allem.

PLATE V. FIG. 37.

Natural Order. Leguminoseæ.

Alternative Names. Jacaranda-wood. Jacaranda Cabiuna in the Central and Southern Provinces of Brazil (76). Caviuna : possibly Palissander-wood (131). Palissandre : Jacaranda preto in Brazil (99).

Sources of Supply. Brazil. West Indies.

Physical Characters, etc. Recorded dry-weight 53¼–65¼ lbs. per cu. ft. Hardness Grades 2–4, very variable, compare anything from Elm to Ebony. Smell fragrant and characteristic, like rose-water. Taste none, or faintly bitter. Burns like a torch with a long, lively, smoky flame : heat expels a copious juice : embers glow in still air. Solution with water very strong, deep-brown.

Grain. Coarse but even, the pores being filled up. Surface, like Ebony, rather dull, very dense, the pores shining.

Bark. ?

Uses. A valuable, highly-prized furniture-wood, chiefly used for piano-cases.

Authorities. J. Miers (76). Laslett (60), p. 284. Wiesner (131), L. 6, p. 253. Saldanha da Gama (99).

Difficult to distinguish from other nearly-related Rosewoods.

Colour. Blackish or purplish-brown, very dark, sometimes banded or striped with black and brown.

Anatomical Characters. Transverse section :—

Pores. Just visible by means of their size and reflection : size 2 : evenly distributed but sometimes a loose pore-ring of a single row : rare, 0–11 per mm : occasionally grouped or subdivided, mostly single, many pairs and a few threes : nearly always with ruby or black contents.

Rays. Very obscure, visible with difficulty, need micro., size 5–6 : much less than a large pore-width apart : gently undulating, not avoiding but rather interrupted by the pores : numerous, 12–14 per mm : laxer than the ground.

Rings. Obscure : frequent bands of colour and narrow black lines which do not of necessity indicate the layers of growth, often eccentric to the true rings (see below).

Soft-tissue. Frequent in fine, concentric lines (with micro.

and a strong light), appears golden in the solid : also narrowly encircling the pores : size varying from 4–6 (ray-scale), and about 5–7 per mm. : not everywhere visible, *apparently absent in the black bands.*

Radial Section. Pores almost always filled with black gum or resin more easily seen by reflection. Rays visible in certain lights, very small, inconspicuous, narrow, shining flakes. Rings not traceable, but the pigment-bands are very prominent.

Tangential Section. As the Radial, but the rays are minute lines scarcely traceable with the micro. (2 inch objective).

Type specimens from commercial sources. Not authenticated but no doubt this species. The extreme variation in some respects points rather to more that one species.

A specimen sent me under the name of "Wanx River Rosewood," undoubtedly a Dalbergia, but differs from the above in the large pores, size 1, the weight 44 lbs. per cu. ft., the Hardness, Grade 3, compare Blackthorn, and the colour, which is nut-brown or walnut.

A second variety sent me as "Madagascar Rosewood," also belongs to this genus, and agrees with D. nigra but has a rather different smell, rather fewer rays (8–10 per mm.), a well-defined pore-ring with pores rapidly diminishing in size from the inner to the outer side of the ring and practically no soft-tissue encircling the pores.

A third variety has been sent me as "Bahia Rosewood."

No. 54. INDIAN ROSEWOOD. Dalbergia latifolia. Roxb.

PLATE V. FIG. 37.

Natural Order. Leguminoseæ.

Synonyms. D. marginata. Roxb. D. javanica. Miq.

Alternative Names. Blackwood in Southern India and very many others in the Indian vernacular (see Gamble). Bombay or Rosetta Rosewood.

Sources of Supply. Oudh, Eastern Bengal, Central and Southern India, Malabar, Kanara (37).

Physical Characters, etc. Recorded dry-weight 46–64 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell fragrant, like rose-water. Taste none. Solution with water, sepia : afterwards with cold alcohol, purple. Burns well with lively flame, embers glow in still air, gives off the typical Dalbergia smell during combustion.

Grain. Very even, though moderately coarse and open. Surface bright, the pores dull, the rays shining, the ground bright.

Bark. "Grey or greyish-brown, $\frac{1}{3}$ to $\frac{3}{8}$ in. thick, with irregular, short cracks, exfoliating in thin, fibrous, longitudinal flakes" (37).

Uses, etc. Furniture of the best class, especially the cases of pianos: turnery, carving, marquetry, etc., in Europe. "Gun-carriages, felloes, naves for wheels, carving, etc., in India . . . very durable and strong and of great beauty" (37).

Often confused with Brazil Rosewood and also many other kinds of Dalbergia.

Authorities. Gamble (37), p. 127. Nördlinger (86), vol. vii. p. 14. Laslett (60), p. 208. Holtzapffel (48). Kew Guide (57).

Colour. Reddish or purplish-brown streaked with black. Sap-wood "yellow, small" (32).

Anatomical Characters. Transverse section :—

Pores. Inconspicuous though clear, no contrast, size 2, little variation: evenly distributed: rare, 0–6 per mm.: occasionally grouped or subdivided, mostly pairs: usually with amber contents which reflect the light in solid section.

Rays. Very obscure, discernible with difficulty even in thin section, size 5, fine: equidistant, less than a pore-width apart: gently undulating, not avoiding but rather interrupted by the pores: numerous, 6–8 per mm.: denser and darker than the ground-tissue in thin section but lighter in the solid wood.

Rings. Obscure yet well-defined: the bands of colour and narrow black pigment zones not necessarily indicating the annual growth. The soft-tissue may form the boundary, as there is a tendency for the pores to form a loose pore-line and to occur in greater numbers near these lines.

Soft-tissue. Abundant in fine concentric lines, rather lighter in colour and larger than the rays: size 4–6 (ray scale): also in narrow borders encircling the pores, often connecting them.

Pith. ?

Radial Section. Pores readily visible, black lines, containing black drops: rays visible in certain lights, very small, inconspicuous, shining, narrow flakes.

Tangential Section. As the Radial, but the rays are minute, reddish-brown lines about 0·2 high (need micro.).

Type specimen from commercial sources. Not authenticated but checked by the specimens in the Museum, No. 1, Kew.

No. 55. ROSEWOOD. Dalbergia sp.

PLATE V. FIG. 37.

Alternative Names. Honduras Rosewood.

Physical Characters, etc. Recorded dry-weight 68 to $77\frac{1}{2}$ lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell and taste faint if any. Burns well with a lively flame and the typical Dalbergia smell. Heat expels a fluid.

Grain. Very even though moderately coarse and open, the pores being rare. Surface bright.

Bark. ?

Uses, etc. An important furniture wood: turnery, inlaying, etc.

Colour. Nut-brown streaked with narrow black lines sharply defined from the brownish-white sap-wood, which is about 1 to 1½ inches wide.

Anatomical Characters as D. latifolia with the following slight variations. Transverse section. Pores visible from their size and lustre, size 1–2. Rays, clear with lens even in the black bands, numerous 7–15 per mm., size 5–6: large celled, lax. Contour of the rings often crenate (i.e. in waves convex outwards) in undulations. Soft-tissue more visible in the black bands: 2 to 4 per mm., irregularly recurring. In Tangential Section owing to the crenate contour of the rings, there is often a pretty zigzag, toothed appearance of the loops and fringes.

Type specimens from commercial sources not authenticated.

No. 56. PURPLE EBONY. Dalbergia sp.

PLATE V. FIG. 37.

Natural Order. Leguminoseæ.

From Ceylon.

Physical Characters, etc. Recorded dry-weight 53½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell and taste none. Burns very well with a lively, spurting flame and a peculiar though not strong aroma. Solution with water, brown, with a slight olive shade: with alcohol, deep reddish-purple, very strong.

Grain. Rather coarse and open. Surface bright, that of the rays woolly on a cleft section.

Bark. ?

Uses, etc. Cabinet-making, turnery, inlaying: very difficult to split, surface when cleft fibrous.

Colour. Rich, dark-purple, streaked with black.

Anatomical Characters, etc. As D. latifolia with the following slight variations. Transverse Section:—

Pores. Readily visible, size 1, coarse: few 4 to 8 per sq. mm. single or in radial groups of 2 to 5, rarely the latter and rarely containing resin or gum.

Rays. Need lens, size 5, fine: 9 to 11 per mm.; continuously traceable over light or dark bands.

Rings. No indication, only the alternating light and dark bands.

Soft-tissue. Abundant in concentric bands about their own width

apart, size about 4 or less, undulating and continuous. Consists of small, rather thinly-distributed cells : also encircling the pores.

In the Radial Section the pores are bright grooves with chambers shorter than their width. In Tangential Section, they are as wide as they are long owing to their oval shape.

Type specimen from commercial sources not authenticated.

No. 57. NICARAGUA ROSE-WOOD. Dalbergia sp.

PLATE V. FIG. 37.

Natural Order. Leguminoseæ.

Source of Supply. Central America.

Physical Characters, etc. Recorded weight 70 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell faintly but characteristically fragrant. Taste none. Burns like a torch, ignites readily, gives off a characteristic "Dalbergia" smell : heat expels resin. Solution with water amber : afterwards with cold alcohol much stronger in colour, which increases but little upon boiling, but becomes rather redder.

Grain. Moderately coarse and open ; the pores, though large, are inconspicuous, being rare. Surface bright, feels smooth to the touch like marble.

Bark. ?

Colour. Brilliant orange or reddish-orange streaked here and there with narrow black lines.

Anatomical Characters. Transverse section :—

Pores. Not readily visible, though large : size 2, not much variation : evenly distributed but in zones : rare, 0–12 per sq. mm. according to the number in the groups which are subdivided, clustered or radial, and from 2–7 pores each : nearly always with amber contents : nearly round when single.

Rays. Need lens and then clear even in the black lines : size 5–6 or 7, uniform : equidistant, much less than a large pore-width apart : nearly straight, not avoiding but interrupted by the pores : numerous, 16–19 per mm. : lax and large celled : lighter than the ground.

Rings. Obscure : the black bands rare ; perhaps a loose pore-zone.

Soft-tissue. Encircling the pores and in extremely fine, lighter-coloured bars between the rays, making a fine net-work : about the same width as the rays, size 5–6 (ray-scale), and about 10 per mm. : not continuous : also a few concentric, lighter-coloured lines about size 4, like other Dalbergias, but rare and irregular, and more like ring boundaries.

Radial Section. Pores rare, readily visible without contrast

of colour, dull but usually with ruby or black drops : rays exceptionally small : soft-tissue very clear as tails to the pores.

Tangential Section. As the Radial, but the rays appear as crowded, ruby, spindle-shaped lines (micro.) : and the soft-tissue as a regular series of bars about size 4 (ray-scale).

Type specimen from commercial sources. Unauthenticated but no doubt a Dalbergia from the structure.

No. 58. ROSEWOOD. Dalbergia sp.

PLATE V. FIG. 37.

Natural Order. Leguminoseæ.

Alternative Names. Honduras Rosewood. "Wanx River Rosewood" (?).

Physical Characters, etc. Recorded dry-weight 68–77 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell faint if any. Taste none. Solution with water pale pink, rather deeper with alcohol. Burns with a lively flame and the typical "Dalbergia" smell : heat expels resin or gum.

Grain. Very even though moderately coarse and open, the pores being rare. Surface bright, due to the ground : rays almost invisible, the pores dull.

Bark. ? The surface of the log beneath is striated.

Uses. An important furniture wood: turnery and inlaying.

Colour. Nut-brown, streaked with narrow black lines. Sapwood brownish-white, sharply defined from the heart ; about 1–1½ inches wide.

Anatomical Characters. Transverse section :—

Pores. Visible from their size and lustre : size 1–2, little variation except within the groups : evenly distributed : rare, 0–5 per sq. mm. : often subdivided, in radial rows of 2–6 pores, many single : nearly always with black or ruby contents : round or nearly so.

Rays. Clear enough with the lens even across the black bands : size 5–6 : much less than the width a large pore apart, not avoiding but apparently interrupted by them, nearly straight : 7–12 per mm. : darker than the ground in transparent section, lighter in the solid.

Rings. Obscure yet well defined, the bands of colour not of necessity indicating zones of growth : contour often crenate.

Soft-tissue. Abundant in fine concentric lines rather lighter in colour and wider than the rays : size 4 to 6 (ray-scale), and also in obscure, very narrow borders to the pores ("more visible in the black bands, 2–4 per mm., occurring irregularly").

Radial Section. Pores readily visible, scarce brown or black lines, usually with black or ruby contents : rays minute, hoary

lines, difficult to see: the colour bands prominent, black and brown, sharply defined: soft-tissue visible as tails to the pores.

Tangential Section. As the Radial, but the rays are minute lines, needing considerable magnification, and the rings or bands from their crenate contour exhibit a very pretty zigzag, toothed arrangement of loops and fringes.

Type specimen from commercial sources, not authenticated.

No. 59. LOGWOOD. Hæmatoxylon campechianum. Linn.

PLATE V. FIG. 38 (*see below*).

Natural Order. Leguminoseæ.

Sources of Supply. Brazil. West Indies and Central America.

Alternative Names. Palo de, or Pao Campeche: Campeachy-wood: Bois de Nicarague: Bois de Sang (105). Blauholz: Blutholz (131). Mahogany (99).

Physical Characters, etc. Recorded dry-weight 50½ to 67 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell little if any: "like violets" (131). Taste faint and peculiar, but neither "bitter" (76) nor "sweet" (131). Burns well and quietly: no aroma: embers glow in still air. Solution in water (not distilled) port-wine colour, much intensified by potash: in alcohol, a beautiful greenish-yellow, which turns an intense crimson upon the addition of potash. Wiesner says, "Solution in distilled water yellow, and in water containing lime, violet, then carmine-red" (131).

Grain. Rather coarse. Surface dull except in radial section.

Bark. "Dark brown, exfoliating in small plates" (37).

Uses, etc. A dye-wood and occasionally for fancy-ware. Usually comes to market in small billets about 3 to 4 ft. long (109), "10 to 20 ft. long" (Miers).

Authorities. Gamble (37), new ed., p. 270. Miers (76). Wiesner (131), p. 930. Kew Guide (57), p. 40. Sinclair (109). Saldanha da Gama (99).

Colour. Heart-wood red or mahogany-red, sharply defined from the narrow (37) white sap-wood. "Warm reddish-brown, much like Partridge-wood" (76) (not the Partridge-wood of the English market). Darkens upon exposure.

Anatomical Characters. Transverse section:—

Pores. Conspicuous from their arrangement in concentric festoons: size 3, little variation: imbedded and connected by soft-tissue: usually single, rarely more than pairs: widely separated: few, 7 to 26 per sq. mm.: many contain a white deposit.

Rays. Need lens, size 5 to 6, uniform: long, too fine to taper appreciably: numerous, 5 to 9 per mm.: lighter in colour than

the ground-tissue : weak, but scarcely avoiding the pores, about a pore-width apart.

Rings. Very clear, or rather certain : alternations in density are conspicuous to the unaided eye.

Soft-tissue. Abundant and conspicuous, forming the festoons connecting the pores, frequently branching and anastomosing.

Pith. Cylindrical, about 2 mm. wide : as hard as the wood.

Radial Section. Pores, prominent dark groves usually lined with shining gum, but also often plugged with a white substance.

Rays. Readily visible, but inconspicuous dark lines or flakes.

Tangential Section. As the Radial, but the rays appear as minute lines, about 1½ to 2 mm. high : sharply cut : need strong lens.

Type specimen from commercial sources, but without doubt this species.

Fig. 38, Plate V. (Baphia) serves to illustrate the structure of this species also.

No. 60. CAMWOOD. Baphia nitida. Afzel.

PLATE V. FIG. 38.

Natural Order. Leguminoseæ.

Source of Supply. West Africa.

Alternative Names. Caban : Cambalholz (131). Barwood. Red Rosewood (99). Wiesner states that Barwood is either the wood of Pterocarpus santalinoides, L'Herit. or P. angolensis D.C., and that it possesses a specific gravity of 0·62 (38¾ lbs. per cu. ft.), also that it is very similar to East Indian Sandal-wood. The names of Barwood and Camwood are frequently quoted as being interchangeable (see Boulger, p. 417), but Holtzapffel treats them as independent species, and Wiesner's statement is strong evidence in support of the correctness of this view. My specimen was sold to me as Barwood, but I prefer to think that it was misnamed.

Physical Characters, etc. Recorded dry-weight 59½ to 67¼, Hardness Grade 1, compare Ebony. Smell or taste none. Burns well without aroma : heat does not expel gum or resin : embers glow in still air. Solution in cold water, claret colour, very strong : turns amethyst-violet upon the addition of potash : no ppt. The alcoholic solution is olive, turning claret-colour with potash.

Grain. Rather coarse and dense. Surface bright.

Bark. ?

Use. A dye-wood. "Walking sticks" (107).

Authorities. Wiesner (130), pp. 936 and 939. Boulger (12), p. 417. Holtzapffel (48), pp. 73 and 78. Scott-Elliott (107).

Colour. Reddish-orange. "Reddish-brown to brownish-violet" (131). Darkens upon exposure.

Anatomical Characters. Transverse section :—

Pores. Conspicuous from their arrangement, size 3 : few, single or in small groups of 2 to 3 embedded and connected by soft-tissue into short arcs suggesting at times a fragmentary pore-ring.

Rays. Just visible to good sight, size 5 to 6, uniform, weak, not avoiding the pores : tapering both ends to fine points : about a pore-width apart : lighter in colour than the wood : 6 to 9 per mm.

Rings. Doubtful, no certain limit, but the arrangement of the pores at times suggests a boundary, but this usually much interrupted.

Soft-tissue the most conspicuous feature : in arcs connecting the pores : sometimes branched.

Pith. ?

Radial Section. Pores rather coarse, chambered grooves : often stopped by pellets of a whitish substance. Rays, inconspicuous lines visible by contrast of lustre only. Soft-tissue, lighter-coloured lines.

Tangential Section as the Radial, but the rays appear as minute lines about 1 mm. high, and the soft-tissue as fringed loops and lines.

Type specimen from commercial sources, not authenticated.

No. 61. SAPPAN-WOOD. Cæsalpinia Sappan (?) Linn.

PLATE V. FIG. 38 (*see below*).

Natural Order, Leguminoseæ.

Synonyms. C. angustifolia. Salisb. C. Sappoa. Linn. C. Sapang. Nor.

Alternative Names. For those in the Indian dialects see Gamble, Bukkum-wood : Narrow-leaved Braziletto. Bois de Sappon in the Isle de France (3). Roro in Tidore. Solau in Ambon : Gabanholz (130). Ostindische Rothholz : Japanholz (131). Tjang in Bali. Sitjang in the Sunda Archipelago (23).

Sources of Supply. Tropical Asia. South India, Burmah. Siam. The Philippines.

Physical Characters, etc. Recorded dry-weight 60 to 61 lbs. per cu. ft. Hardness Grade 1, excessively hard, compare Ebony. Splits readily and cleanly. Smell or taste none. Burns well, but the embers expire in still air, leaving the carbonized wood : heat expels drops of gum. Solution with hot water, olive-brown,

none with cold water. The watery solution turns an intense brownish-purple upon the addition of potash.

Grain. Rather coarse, but dense and even. Surface lustrous, metallic : that of the rays and pores dull.

Uses, etc. A dye-wood. Usually met with in the form of roughly-hewn sticks or small billets, with an occasional trace of the sap-wood still adhering.

Bark (of the specimen in the Museum No. 1, Kew), rough, soft and peeling in flakes.

Authorities. Gamble (37), p. 135. Van Eeden (123). Aublett (3). Kew Museum, No. 1. Wiesner (131), L. 12, p. 934.

Colour. Deep orange-red, darkening upon exposure. Sap-wood white, sharply defined from the heart-wood.

Anatomical Characters. Transverse section :—

Pores. Conspicuous, size 3, uniform : rather scarcer in the outer side of the rings : few, 5 to 15 per sq. mm. : in pairs or radial groups surrounded with, and occasionally connected by, soft-tissue. Gamble says, "Pores isolated," which description also agrees with the Kew specimen.

Rays. Need lens, fine, size 5, uniform : long, too fine to taper perceptibly : numerous, about 5 per mm. : lighter in colour and denser than the ground-tissue : weak, but scarcely avoiding the pores : a pore-width or less apart.

Rings. Clear, no definite margin, but apparent through a denser zone of pores succeeding a less crowded one : contour regular.

Soft-tissue. Abundant, surrounding the pores and pore-groups and sometimes connecting two or more groups in a concentric direction.

Pith. Round or roughly triangular : 1½ mm. diameter, of a darker red than the wood : "1 to 12 mm. diameter" (131).

Radial Section. Pores, cellular lines bordered by soft-tissue, causing them to appear dull against the lustrous ground. Rays, inconspicuous, dull flakes. Ring-boundaries imperceptible.

Tangential Section as the Radial, but the pores are more conspicuous as the cut opens the radial groups in the direction of their long axis. Rays, excessively fine lines scarcely visible with lens.

Type specimens from commercial sources, not authenticated, but reputed to be this species. Except in one or two respects they correspond with the specimens at Kew and with Gamble's description. Perhaps my specimens are from the root of the tree while the others mentioned are branches. Wiesner says the wood colours cold water a beautiful and lively red; my specimens do not.

Fig. 38, Plate V. (Baphia) serves to illustrate the structure of this species also.

No. 62. ANGICO. Piptadenia rigida. Bth.

PLATE V. FIG. 39.

Natural Order. Leguminoseæ.

Synonym. Acacia Angico. Mart.

Alternative Names. Queen-wood. Angica do Sertao : Angica vermelho : Zergipe (?) in the Prov. Rio de Janeiro (76). Cangica erroneously in Holtzapffel (48), under "Snake-wood."

Source of Supply. Brazil.

Physical Characters, etc. Recorded dry-weight 71½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell none. Taste slightly astringent. Burns well and quietly without smell, embers glow in still air. Solution with water rich red to brown : afterwards with alcohol none.

Grain. Fine : open or close : dense, smooth. Surface scarcely lustrous : the pores have a pitchy lustre.

Bark. ?

Uses, etc. Turnery, cabinet-making, and ornamental work.

Authorities. Holtzapffel (48), p. 106. Nördlinger (86), vol. ix. p. 23. Miers (76).

This wood may be met with in the form of trimmed logs from 6 to 10 inches in diameter (48). It can easily be confused with certain kinds of Rosewood and with Sabicu.

Colour. Reddish-brown or dark-brown striated with black : sap-wood (?).

Anatomical Characters. Transverse section :—

Pores. Readily visible in the light zones from their colour ; coarse, size 2, little variation except in the groups ; collected rather more in some zones, otherwise uniformly scattered ; groups radially disposed, subdivided, from 2–6, mostly single though many pairs ; usually with dark contents : rather numerous 15 to 75 per mm.

Rays. On the limit of vision size 5 or 5–6, uniform : equidistant, a pore-width or less apart, thin, avoiding the pores 5–7 per mm. : tapering both ends : lighter than the ground-tissue.

Rings. Not indicated by any clear boundary : pores rather fewer in some zones than in others, the colour zones of brown and black are prominent.

Soft-tissue. In prominent, golden borders, imperfectly surrounding the pores : (appear perfect in the solid), clearer in dark specimens by reflected but not by transmitted light.

Pith. ?

Radial Section. Pores fine, black, but readily visible lines with shining linings and sometimes yellow or black contents. Rays inconspicuous flakes visible by contrast of lustre not of colour. Rings, doubtful, but the colour zones are very striking.

Tangential Section. As the Radial, but the rays are minute vertical lines about 0·75 mm.

Type specimen from commercial sources, not authenticated, but the structure agrees with that of Nördlinger's section (under syn., Acacia Angico) and also with Miers' description.

No. 63. SWEET-SCENTED MIMOSA. Albizzia odoratissima. Bth.

PLATE V. FIG. 40.

Natural Order. Leguminoseæ.

Synonyms. Acacia odoratissima. Willd. Mimosa odoratissima. Roxb.

Alternative Names. Hurihi in Ceylon (12). Suriya mârâ or Hure mârâ and many others in the various dialects of India, see Gamble and Watt.

Sources of Supply. India, Burmah, and Ceylon.

Physical Characters, etc. Recorded dry-weight 42 to 60 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell fragrant like rose-water. Solution with water, brown to red. The light red or brown scrapings from the wood are turned to an olive colour by alcohol ?

Grain. Rather coarse, even and dense. Surface lustrous, glassy with dull bands.

Bark. About ¼ inch thick: grey with irregular fissures and patches of a darker colour.

Uses, etc. "Wheels, oil mills furniture, and for all purposes requiring strength and durability" (37). Very hard to saw, splits very easily, does not soil readily. This wood is well worth importing.

Authorities. Gamble (37), p. 158. Nördlinger (86), vol. v. p. 9. Watt (127).

Colour. Heart-wood in bands of brown, walnut and black, or even olive, sharply defined from the very wide, pinkish sapwood.

Anatomical Characters. Transverse section :—

Pores. Prominent, coarse, size 1, variable in size: evenly distributed : rare, only 1 to 2 per sq. mm. : occasionally grouped or subdivided, as many as five in a group, radial groups with a large pore at each end : some with black contents : a tendency to loose, oblique lines.

Rays. Need lens, fine, size 5 : straight but avoiding the pores : long, denser than the ground-tissue : numerous about 4–8 per mm.

Rings. Obscure : the bands of colour have no relation to the structure.

Soft-tissue. In lightly waved, concentric lines as fine as the rays: sometimes simulating the ring-boundaries and often several quite close together: also in broad borders to the pores which sometimes join the groups in oblique or wavy lines.

Radial Section. Slightly lighter in shade than the Transverse Section: pores very prominent, rather coarser than in the Tangential Section as the radial groups are exposed. They often contain black gum and show up as dark grooves. Rays need lens, and are then only visible in certain lights. No indication of the rings.

Tangential Section. As the Radial, but the rays appear as minute lines about 1·3 mm. high (need lens). The pores are exposed in less abundance.

Type specimens authenticated by the Forest Officer to the Government of Ceylon: from a log sent to the Colonial and Indian Exhibition.

No. 64. EAST INDIAN WALNUT. Albizzia Lebbek. Bth.

PLATE V. FIG. 40.

Natural Order. Leguminoseæ.

Synonym. Mimosa Sirissa Roxb.

Alternative Names. The Siris Tree. Cotton-varay in Coromandel (131). For the names in the various Indian dialects see Gamble and Watt.

Sources of Supply. Tropical Asia and Africa. Chiefly India.

Physical Characters, etc. Recorded dry-weight 41 to 56 lbs. per cu. ft. Hardness Grade 5, compare English Ash. Smell or taste none (when dry). Solution the colour of the wood.

Grain. Rather coarse and open. Surface lustrous, silky, not glassy.

Bark. "Grey or brownish-grey, rough with numerous short, irregular cracks" (37).

Uses, etc. Seasons, works and polishes well, and is fairly durable: sugar-cane crushers, oil mills, furniture, well-curbs and wheel-work, and in South India for boats. In the Andamans for building, but more usually for house-posts" (37). "Very durable" (131). "Immune to dry-rot, but not to white ants."

Authorities. Wiesner (131), L. 6, p. 81. Gamble (37), p. 156. Stone (117).

Colour. Dark brown, walnut colour: "Sap-wood large, white" (37).

Anatomical Characters. Similar to those of the A. odoratissima with the following variations:—

Transverse Section. Pores, coarse, size 1, scarcely prominent: rarely subdivided to more than pairs, mostly single, surrounded by a narrow, inconspicuous ring of soft-tissue. Rays, much less than the width of a large pore apart: straight, apparently interrupted rather than avoiding the pores. Rings very obscure: varying shades of colour, but not in definite bands. Soft-tissue rarely joining the groups.

Type specimens sent me by the Imperial Institute for trial and authenticated by various Indian foresters.

No. 65. PADOUK. Pterocarpus indicus. Willd.

PLATE V. FIG. 41.

Natural Order. Leguminoseæ.

Synonym. P. dalbergioides. Roxb.

Alternative Names. Andaman Red-wood: Chalanga dá in India (37): Tenasserim Mahogany (15). Burmese Rosewood (15). Cibicibi in Fiji (12). Angsanah in Malacca (24). *See below.*

Sources of Supply. Burmah and the Andaman Isles.

Physical Characters, etc. Recorded dry-weight 43-62 lbs. per cu. ft. Hardness, Grade 3, compare Blackthorn. Smell little if any. "Aromatic" (37). Taste astringent. Burns well: embers glow in still air. Solution with water faint brown: with alcohol deep crimson, the colour of the wood.

Grain. Coarse, open but dense: irregular, in hard and soft bands by turns. Surface bright, even lustrous, smooth and cold to the touch.

Bark. "Grey" (37).

Uses, etc. Resists white ants (131). Furniture, railway carriage building, turnery. A wood of great beauty which seasons and works well and takes an exceptionally fine polish, but the soft bands render planing troublesome. The description by Jackson and Graham quoted by Gamble is anything but applicable to the Padouk here described, nor does Gamble's own description bear it out. Jos. Collins describes it as "yellowish, streaked brown." I imagine, he has quoted the wrong systematic name, as has Boulger also (15), p. 37. Padouk is difficult to confuse with any other wood.

Authorities. Gamble (37), p. 130. Laslett (60), pp. 209, 215. Boulger (15), pp. 37 and 269. J. Collins (24). Wiesner (131), Lief. 6, p. 89.

Colour. Rich red or crimson streaked with black. Sap-wood about ½ inch wide.

Anatomical Characters. Transverse section :—

Pores. Conspicuous, size 1-2, rather coarse, little variation:

uniformly scattered : few 0–5 per sq. mm. : mostly single, occasionally subdivided in groups of 2–8 : usually empty.

Rays. Need lens, size 5–6 : uniform : equidistant, much less than width of a large pore apart, not avoiding but interrupted by the pores : numerous, 11-13 per mm : denser than the ground-tissue : appear red against the darker ground.

Rings. Very doubtful : zones of darker wood here and there, but no definite boundary.

Soft-tissue. Abundant in concentric lines linking the pores, visible to the naked eye, size 3 (ray-scale) of the colour of the rays but lighter.

Pith. ?

Radial Section. Very prominent, black, shining grooves. Rays visible but inconspicuous, fine, hoary flakes. Rings not traceable, but the dark vertical bands are frequent. Soft-tissue appears as hoary continuations or tails to the pores, sometimes traceable for an inch or more beyond the pore-grove.

Tangential Section. As the Radial, but the rays are invisible with lens, about 0·3 mm. high and very difficult to make out, and the soft-tissue is in irregular hoary patches.

Type specimens from commercial sources checked by the specimen in the Museum No. 1, Kew, and by Gamble's description.

No. 66. KOWHAI. Sophora tetraptera. J. Mill.

PLATE V. FIG. 42.

Natural Order. Leguminoseæ.

Sources of Supply. New Zealand.

Physical Characters, etc. Recorded dry-weight 48¾ lb. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or taste none. Burns well with much crackling and a faint, peculiar aroma : embers glow in still air : no juice expelled by heat. Solution almost colourless : potash turns it faint golden-brown with a copious golden ppt.

Grain. Fine. Surface scarcely bright.

Bark. Brown, hard, leathery, not fissured : about ¼ inch thick : of one layer. The rays are continued through the bark and are gathered into cone-shaped pencils of about 20 rays, like those found in the bark of Duguetia quitarensis. No. 2.

Uses, etc. "Very tough and hard—cogs—recommended as a substitute for Lignum-vitæ" (24). Works very well.

Authority. Collinson (24).

Colour. Heart-wood whitish or brownish-white, not sharply but clearly defined from the slightly lighter sap-wood, which is about 1½ inches wide.

Anatomical Characters. Transverse section :—

Pores. Very prominent from their arrangement, small, size 5, considerable variation : in festoons resembling those of Elm : usually single : not subdivided : densely crowded in the pore-zones but leaving clear pore-less intervals : many 110 to 200 per sq. mm.

Rays. Readily visible from their light colour, size 3 or 3-4, thick in the middle and tapering to fine ends : "middles," 2-3 per mm., or together with "ends," 3-6 per mm. : firm, not avoiding the pores, much more than a pore-width apart : denser than the ground-tissue.

Rings. Doubtful, as one zone of pores is not distinguishable from another.

Soft-tissue. Abundant, imbedding and compacting the pore-zones.

Pith. ?

Radial Section. Pores, sometimes coarse when a group is exposed, but never prominent. Rays, small, inconspicuous flakes visible by contrast of lustre. Soft-tissue, readily visible in innumerable, parallel white lines.

Tangential Section. As the Radial, but the rays are very obscure, spindle-shaped bodies about 1-1·5 mm. high, and rather broad for their length.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 67. RASPBERRY JAM-WOOD. Acacia acuminata. Benth.

PLATE V. FIG. 43.

Natural Order. Leguminoseæ.

Alternative Names. Raspberry scented Acacia (80) : Jam (12).

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight 78 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smells like raspberry jam, powerful and almost overpowering when freshly cut. Taste similar, but faint and sweetish. Burns badly, maintains a flame with difficulty, smell like burning Rosewood (Jacaranda). Solution with water, brown : with alcohol, deep brandy colour.

Grain. Fine and open, solid and compact, fibrous and sinuous. Surface, when examined with a lens, exhibits a metallic irridescence : pores resinous, rays dull and inconspicuous : ground scarcely bright.

Bark. Deeply fissured, ¼-⅝ inch thick, scaling in brittle pieces : dark brown : of two layers, the inner compact, light brown,

$\frac{1}{8}$ inch thick, soft : the outer, hard, darker, striped in section like the wood.

Uses, etc. "Fence-posts, the best charcoal in Australia" (80). "Very dense, resists white ants, and in the ground seems to last for ever" (17). "Small dimensions" (61). Planes badly, being cross-grained : a handsome wood. Easily confused with Myall-wood and several other aromatic Australian Acacias.

Authorities. K. F. von Mueller (80), p. 16. J. Ednie-Brown (17), p. 19. Laslett (61), p. 431.

Colour. Very dark-brown or purplish-brown streaked with black. Sap-wood, sharply defined from the heart, $\frac{1}{8}$–$\frac{3}{16}$ inch thick, whitish.

Pores. On the limit of vision, can be seen by reflection . size 3–4, considerable variation, diminishing regularly, the Autumn zone poor in pores, sometimes in short oblique lines : mostly single, but many subdivided pairs, threes and fours in egg-shaped groups separated from each other by rays : moderately numerous, 20–40 per sq. mm.

Rays. Need lens or rather micro., size 5–7, uniform : equidistant, less than a pore-width apart : avoiding the pores, rarely straight, weak, thin, golden threads : many, 5–7 per mm. coarse-celled, yet denser than the ground.

Rings. Clear, though not prominent : *the boundary frequently a fine, white line* equal to size 4 (ray-scale), or a line of contrast and a zone poor in pores and *a considerable and striking difference in the size of the Spring and Autumn pores* : contour undulating.

Soft-tissue. Abundant in lop-sided borders to the pores, often extending laterally to oblique or concentric scraps in the Autumn zone.

Pith. ?

Radial Section. The pores are obscure, fine scratches : the rays minute, dull, black, inconspicuous lines : the rings are not traceable, but the light and dark pigmented bands are prominent : the soft-tissue needs the lens, but is abundant as light-brown borders and tails to the pores.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 68. MYALL. Acacia pendula. A. Cunn.

PLATE V. FIG. 43.

Natural Order. Leguminoseæ.

Alternative Names. Weeping Myall in Queensland (5). Boree in N.S. Wales. Violet-wood in England (57).

Sources of Supply. South Queensland. New South Wales. Victoria.

Physical Characters, etc. Recorded dry-weight 76 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell fragrant like violets, more so when worked. Taste nauseous. Burns indifferently well : heat expels a juice along with puffs of vapour : embers glow brightly in still air. Solution, dirty brown.

Grain. Rather fine, slightly sinuous, even, dense. Surface bright. Resin exudes after a time and hardens in globules.

Bark. ?

Uses, etc. "Much prized by cabinet makers and turners" (5). A good turners' wood and for such purposes where hardness is required: ornamental. "Tobacco pipes, stock whip-handles, and by the aborigines for boomerangs" (85).

Authorities. F. M. Bailey (5), p. 53. Nilsson (85), p. 34. Kew Guide, No. 3 (57), p. 69.

Colour. Very dark brown with light coloured lines, few, if any, black bands. Sap-wood. ?

Anatomical Characters. Transverse section :—

Pores. Very prominent from their colour and size, Grade 3 to 4, uniform except within the groups: evenly scattered, perhaps a tendency to wavy lines : groups rarely joined to others : many single or in pairs and threes and fours : contents not readily seen in the solid, but glisten after moistening : 10–25 per sq. mm.

Rays. Need lens, size 5 to 6, uniform : equidistant, a pore-width apart, sometimes penetrating the soft-tissue around the pores : many 8–11 per mm.

Rings. Doubtful, but clear with lens. Boundary a fine white line at intervals, strongly suggesting the boundary : independent of the pores : contour irregular.

Soft-tissue. Abundant in broad, brown borders to the pore-groups, but not connecting them except in crowded rings : perhaps also the ring-boundary (*see above*).

Pith. ?

Radial Section. Pores, prominent as light brown lines *from which the gum often exudes* and stains the wood. Rays, very minute, rather darker flakes. Colour bands rare, if any. Soft-tissue clear as borders to the pores.

Tangential Section. As the Radial, but the rays are very minute, dark lines, blunt rather than spindle-shaped, about 0·2 mm. high.

Type specimen authenticated by F. M. Bailey.

No. 69. MYALL. Acacia homolophylla. A. Cunn.

PLATE V. FIG. 43.

Natural Order. Leguminoseæ.

Alternative Names. Veilchen-holz (131). Wong-arrah on

the Cloncurry River. Gidgee in Queensland (5). Yarran in New South Wales (20). Gidia (12). Spear-wood (85).

Sources of Supply. Queensland, New South Wales, South Australia, Victoria. United States (introduced).

Physical Characters, etc. Recorded dry-weight 66 to 76¾ lbs. per cu. ft. Hardness Grade 1, compare Ebony. Burns indifferently well with a short, crackling flame and a little aroma: heat expels a juice: embers glow in still air. Smell fragrant, like violets, more so when worked. Solution feeble, dirty-brown.

Grain. Very fine, even and dense, exceptionally sinuous, produces a beautiful figure. Splits with a short-waved fracture. Surface lustrous.

Bark. ?

Uses, etc. As those of A. pendula, from which it is difficult to distinguish. "A small tree" (5). My specimen must have been cut from a tree not less than 8 inches in diameter.

Authorities. F. M. Bailey (5), p. 53. Nilsson (854), p. 23. Wiesner (131), L. 6, p. 82. Col. Cardrew (20).

Colour. Heart-wood, dark, rich, reddish-brown, sharply defined from the yellow sap-wood.

Anatomical Characters. As those of A. pendula No. 68. (*See this.*) Transverse section :—

Pores. Clearly visible but not prominent, occasionally in groups of as many as 8 pores.

Rays. Need lens, and then not readily visible.

Rings. The white lines sometimes succeed each other within the Radial diameter of a single pore.

Radial Section. Pores, obscure, dark grooves filled with gum, appear hoary in the darker wood, *very* sinuous. Rings doubtful: the darker zones appear to limit the year's growth.

Tangential Section. As the Radial, but the soft-tissue appears as sinuous, hoary borders to the pores.

Type specimen authenticated by F. M. Bailey.

No. 70. BRIGALOW. Acacia harpophylla. F. von M.

PLATE V. FIG. 43.

Natural Order. Leguminoseæ.

Sources of Supply. Queensland.

Physical Characters, etc. Recorded dry-weight 75½ lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell like that of violets, very sweet. Taste none. Burns moderately well with considerable crackling : no juice expelled by heat : embers glow in still air. Solution, olive, turning brandy colour upon the addition of potash : a copious brown ppt.

Grain. *Straight*, coarse, but close and compact. Surface bright.

Bark. "Rough" (5).

Uses, etc. Turnery and fancy-ware. "Elastic—a good cabinet wood" (5).

Authority. F. M. Bailey (5).

Colour. Heart-wood, purplish-brown: contour somewhat irregular: not sharply defined from the white sap-wood, which is about 1 to 1½ inches wide

Anatomical Characters. As those of Acacia pendula No. 68, but with the following differences:—

Pores. Often (apparently) connected in short, oblique lines: size 3: 10 to 30 per sq. mm. Rays, size 5 to 6: 6 to 9 per mm.

Radial Section. Rays very bright and distinct, though small. Few (if any) gum stains or globules. Pores, inconspicuous grooves on a freshly-cut section, but rapidly becoming prominent on exposure to the air as the soft-tissue turns colour.

Type specimens from commercial sources and also authenticated by F. M. Bailey.

No. 71. AUSTRALIAN BLACKWOOD. Acacia melanoxylon. R. Br.

PLATE V. FIG. 44.

Natural Order. Leguminosæ.

Sources of Supply. South Australia. Introduced into S. Africa, the United States of America, India, and the Cape of Good Hope.

Alternative Names. Black Wattle of the Nilgiris (37). Lightwood (85), in New South Wales.

Physical Characters, etc. These appear to differ very much in the various regions where they have been introduced. Recorded dry weights, 36 to 42 lbs. per cu. ft. (37); 41 to 48 lbs. (83). My specimens are partly sap-wood. Hardness of South Australian specimen Grade 7, compare English Birch; of North American specimen, Grade 3, compare Blackthorn; of South African specimen, Grade 6, compare English Beech. Smell or taste none. Burns well and quietly without aroma; no juice expelled by heat: embers glow in still air. Solution olive turning brandy colour upon the addition of potash: no ppt.: after extraction with water the chips do not yield any further colour with alcohol.

Grain. *Straight,* fine, and even. Surface rather lustrous, does not exude drops of resin.

Uses, etc. Works easily: the most promising of all the Australian Acacias on this account. "Very durable, finely

A handsome wood: splits and planes easily (one way of the grain) notwithstanding its hardness.

Colour. Dark brown with bold black streaks. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. Readily visible, prominent when white, size 1, coarse, little variation: *evenly distributed, isolated* except where subdivided into compact groups of 2–3 (rarely more), mostly single; round or oval; often with red or *milk-white contents.*

Rays. Require lens, fine, size 5, uniform; equidistant, much less than a large pore-width apart: running round or stopped short by the pores: numerous, 6–9 per mm.; much denser than the ground-tissue: appear red against the dark ground; nearly straight.

Rings. Very doubtful: zones of darker wood here and there: contour uniform.

Soft-tissue abundant in broad borders encircling the pores sometimes extending laterally into spindle-shaped patches; cells very coarse, size 6 (pore-scale), also many fine, black concentric lines, (in transparent section), which appear white in the solid; size 6.

Pith. ?

Radial Section. Colour rich hazel-brown with black lines; much lighter in shade than the transverse section. Pores prominent, mostly black, some white. Rings doubtful. Soft-tissue traceable as black, spongy continuations or tails to the pores.

Tangential Section. As the radial but the pores appear as bold, black, broad lines. Unusually prominent. Rays, fine dark lines about 0·5 mm. high. Rings. Rather prominent, not defined, rather of a watered appearance.

Type specimen from commercial sources, not authenticated.

No. 73. SABICU. Species unknown.

PART VI. FIG. 46.

Natural Order. Leguminoseæ.

Physical Characters, etc. Recorded dry weight 43½ lbs. per cu. ft. Hardness Grade 5, compare English Ash. Smell and *taste none.* Burns indifferently well with a faint aroma: embers glow in still air. Solution with water reddish, appears at *boiling-point* only.

Grain. Moderately fine and open. Surface scarcely lustrous, the pores glistening, the ground bright, *not waxy to the touch.*

Bark. ?

Uses. A substitute for Mahogany, for which it may easily be mistaken.

Colour. Dark red not streaked with black or light brown. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. Readily visible, not prominent, rather coarse, size 1–2, little variation : evenly distributed, but loosely grouped in oblique, radial lines sometimes reversed in their direction in succeeding rings : few 4–10 per sq. mm. : mostly single many pairs, occasionally subdivided in groups of 3–5 pores : often with red but not white contents.

Rays. Require lens, size 5–6, uniform : equidistant much less than the width of a large pore apart, running round and interrupted by the pores : numerous 9–11 per mm. : much denser than the ground : nearly straight : appear red against the dark ground.

Rings. Very doubtful : zones of darker wood here and there but no definite boundary : an occasional fine dark line.

Soft-tissue. Abundant in irregular, broken borders encircling the pores apparently uniting them to oblique lines : diminishing in width between the pores.

Pith. ?

Radial Section. Pores fine but readily visible lines : no contrast : glisten from the drops within. Rays scarcely visible, fine lines rather than flakes. Rings very vague. Soft-tissue greyish, traceable as spongy tails to the pores.

Tangential Section. As the Radial, but the rays are fine, vertical lines about 0·1 mm. high, and the soft-tissue is never prominent but is readily visible with lens in favourable sections.

Type specimen from commercial sources, not authenticated.

No. 74. PURPLEHEART. Copaifera (possibly bracteata var. pubiflora. Bth.)

PLATE VI. FIG. 47.

Natural Order. Leguminoseæ.

Synonym. Copaifera = Copaiba. Adans = Copaiva. Jacq.

Alternative Names. Marawinaroo : Marawayana (78) : Kooroobovilli (12) in British Guiana : Purpuurhart (12) in Dutch Guiana. Bois violet : Amarante (99) in French Guiana and Brazil. Purplewood. Those names resembling Copaiva and Courbaril are more properly applied to Copaifera officinalis. (Fig 144, Pl. xvi.) Possibly the Violettholz, Luftholz or Blaues Ebenholz of the Germans (68). Marawagana : Simiridi (99) in Brazil.

Sources of Supply. Tropical America, chiefly British Guiana.

Physical Characters, etc. Recorded dry-weight 49 to 62 lbs.

per cu. ft. Hardness Grade 2, compare Boxwood. Smell or taste none. Burns well, embers glow in still air, and consume exceptionally slowly: the heat brings the purple colour out. Solution with water dark brown.

Grain rather coarse and open. Surface comparatively dull: rapidly becomes purple upon exposure. A log received in a very wet (green) condition turned colour before my eyes after being sawn in half.

Bark. Resembles that of Beech but is of a brick-red tinge; about ¼ inch thick.

Uses, etc. "Mill-beds, mortar-beds, house-framing, and all purposes where shock has to be resisted—durable" (78). "Ramrods, buhl-work, marquetry, and turnery" (48). "Less durable than Kooroobooilli; capable of resisting great strain; may be met with in logs from 100–120 ft. long by 30 inches in diam., free of sap-wood" (72). Almost invariably confused with the other species of purpleheart, but never with anything else.

Authorities. McTurk (78). Ditto (72). Cat. Kew Museum No. 1. Holtzapffel (48), p. 103. Martin (68), p. 226. Saldanha da Gama (99). Wiesner (131), L. 12, p. 927.

Colour. Brown heart-wood turning purplish on exposure; well but *not sharply defined* from the dirty-white sap-wood. The phenomenon of the change of colour is evidently due to oxidation. It is quite superficial as when freshly planed the surface is brown and the purple colour disappears when the wood is polished with a spirit varnish.

Anatomical Characters. Transverse section:—

Pores. Conspicuous and large, size 1–2 (or rather larger), varying in no particular order in the individual ring, but the average size increasing as the tree ages: uniformly scattered: few 1–6 per sq. mm.: single, or in pairs or threes; often filled, beautifully round when not subdivided.

Rays. Clearly visible, size 5–6: uniform: more or less equidistant, about the width of a large pore apart (sometimes less) weak but otherwise straight, scarcely avoiding the pores: numerous 5–7 per mm.: very short, frequently tapering both ends: whitish: much denser than the ground-tissue.

Rings. Doubtful: the fine, whitish lines may indicate the boundary.

Soft-tissue. Abundant, chiefly in large, spindle-shaped patches enclosing the pores or joining two or more groups. The most prominent feature: perhaps the fine, whitish, concentric lines may also be soft-tissue.

Pith. ?

Radial Section. Considerably lighter in shade than the transverse section, the pores are inconspicuous though large, and

are obscured by soft-tissue which forms numerous, narrow, inconspicuous, grey borders to the pores. The rays are prominent though small flakes.

Tangential Section. A shade lighter than either of the above. The rings are sometimes traceable, are cloudy lines or loops. The rays need lens being extremely fine lines about 1·0 mm. high and the borders to the pores are several times as broad as in the Radial section.

Type specimens authenticated by the Forest Officer to the Government of British Guiana.

No. 75. PURPLEHEART. Copaifera sp.

PLATE VI. FIG. 47.

Natural Order. Leguminoseæ.

Synonyms. See No. 74.

Alternative Names. KooroobaIli : Kooroobooilli (12). Compare also Courbaril and other corruptions of an European origin. See also No. 74.

Sources of Supply. South America, chiefly British Guiana. Surinam, Brazil.

Physical Characters, etc. Recorded dry-weight 53 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell and taste none. Burns well, embers glow in still air, and consume slowly away to the ash. The heat brings out the purple colour. Solution with water purplish-brown, afterwards with alcohol more purplish. Upon drying a purple sediment is left.

Grain fine and open. Surface rather dull, the pores being the brightest part.

Bark. ?

Uses, etc. As those of C. bracteata (No. 74), with which this species is always confused. Difficult to distinguish from Demerara Purpleheart also. For *Authorities* see foregoing species.

Colour. Dark brown heart-wood, turning deep purple or magenta upon exposure. Sap-wood. ?

Anatomical Characters. Transverse section. Pores. Conspicuous though not large, size 2–3, varying in no particular order in the individual ring but increasing slightly as the tree ages : uniformly scattered : few, 2–12 per sq. mm. : single but more often in nested groups of 3–5, enclosed in small spindle-shaped patches of tissue which are not nearly so coarse as in C. bracteata : often filled.

Rays. Visible in certain lights, size 5–6 : uniform : equidistant : about the width of a large pore apart : weak but scarcely avoiding the pores : numerous, 5–7 per mm. : much denser than the ground : brown.

Rings. Doubtful. There are abundant fine, whitish lines which may indicate the boundary of the year's growth.

Soft-tissue. Abundant, chiefly in spindle-shaped patches enclosing a pore or group or joining up 2 or more groups: also fine concentric lines (see Rings).

Pith. ?

Radial Section. Pores inconspicuous, sometimes obscured by the soft-tissue: rays inconspicuous, brown flakes: rings just visible when two or more lines occur close together.

Tangential Section. As the Radial, but the rays are fine lines about 0·1 mm. high, and the rings are doubtful.

Type specimen from commercial sources. Not authenticated but without doubt a Copaifera. I believe this to be the Kooroobooilli described by McTurk. This is the kind most frequently met with in England.

No. 76. DEMERARA PURPLEHEART. Copaifera sp.

PLATE VI. FIG. 47.

Natural Order. Leguminoseæ.

Alternative Names. Practically the same as those applied to the other species of Purple-heart with the exception of their strictly local names.

Sources of Supply. British Guiana. The Moluccas.

Physical Characters, etc. Recorded dry-weight 50½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell or taste none. Burns well with a crackling flame, embers glow in still air: the heat brings out the purple colour upon the brown surface of freshly cut wood. Solution with water golden yellow.

Grain very fine, open. Surface bright to lustrous, the ground-tissue the brightest part.

Bark. ?

Uses. The same as of the other species of Purple-heart (which see). Usually confused with the other woods of the same name but never with anything else.

Colour. Heart-wood brown turning to pinkish-purple (with a little magenta) in a very short time upon exposure. My specimen, which was quite dry, turned colour in the course of an hour after being planed.

Anatomical Characters. Transverse section :—

Pores. Conspicuous by reason *of their numbers* not of their size: little variation, size 2–3: uniformly distributed, *crowded* throughout the whole section, very densely in some zones: many 12–35 per sq. mm.: mostly paired, a few radial groups of 3–5: accompanied but *not surrounded* by small *irregular*

patches of soft-tissue, *difficult to make out in the transparent section* : mostly filled with resin.

Rays. Difficult to see with lens in the solid, size 5–6 uniform : equidistant, more than the width of a large pore apart : lack contrast with the ground-tissue although much denser : many about 5 per mm. : undulating, not avoiding the pores : long, not often tapering.

Rings. Doubtful : the occasionally fine lines which are of denser wood (not soft-tissue) may indicate the boundaries of the year's growth.

Soft-tissue in small, irregular patches adjoining, but not surrounding the pores. The small amount of this makes the pores appear much smaller than those of other Copaiferæ, whereas they are much about the same size.

Pith. ?

Radial Section. Lighter in shade than the transverse section. The pores are fine but readily visible lines with much red resin. The rays are visible in certain lights. The rings are doubtful, and the soft-tissue is *scarcely visible.*

Tangential Section. As the Radial, but the pores appear prominent on account of the number of their borders of soft-tissue which are lighter than the ground-tissue. The rays need the lens, being very minute lines about 0·5 mm. high. The rings are a little plainer as the denser zones of pores make themselves evident here and there.

Type specimen from commercial sources, not authenticated, but without doubt a Copaifera.

No. 77. WALLABA. Eperua falcata. Aubl.

PLATE VI. FIG. 48.

Natural Order. Leguminoseæ.

The E. falcata of Blanco = Afzelia rhomboidea of Vidal and not the present species.

Synonym. Pangera falcata. Willd.

Sources of Supply. British Guiana : Brazil : Dominica.

Alternative Names. Pois sabre : Wapa (78). Jebaru-rana : Vouapa-tabaca : Baiñha de Espada in Guiana (3) and the Amazonas region (76) : Parive : Eperu in French Guiana (3). Wapa huileux : Wapa Patouve in Brazil (99).

Physical Characters, etc. Recorded dry-weight 65½ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn or Whitethorn. Smell and taste like Creasote. Burns noisily and badly, maintains a flame with difficulty but embers glow in still air. Solution with water faint-yellow : afterwards with alcohol, crimson.

Grain. Very coarse but more or less even as a large number of the pores are filled. Surface dull: pores bright but not shining: the wood soon becomes disagreeably sticky.

Bark. Smooth, not fissured but apparently shelling off in thin plates: $\frac{3}{8}$ to $\frac{1}{2}$ inch thick: grey or black.

Uses, etc. "Chiefly for shingles, which have been known to last 40 years—stands exposure under all circumstances: may be met with in logs from 30 to 80 ft. long by 15 to 20 in. square free of sap-wood" (78). Splits very easily and fairly cleanly.

Authorities. Saldanha da Gama (00). Nördlinger (86), vol. vii. p. 45. McTurk (78). Miers (3).

Colour. Purplish-red heart-wood (like dried blood) sharply defined from the dirty-white sap-wood.

Anatomical Characters. Transverse section:—

Pores. Conspicuous, Size 2, moderate-sized: variable: evenly distributed except where collected in a 1-rowed ring of small pores: few 2–9 per sq. mm. (in the pores-ring): single or from 2–5 in well-closed, radial, subdivided groups: appear light-red in the solid wood: occasional amber or red contents which exude copiously.

Rays. Clearly visible, medium; size 3 or 2–3, uniform: equidistant, less than the width of a large pore apart: gently undulating but not avoiding even the larger pores: numerous, 7–8 per mm.: unusually long, rarely tapering if at all: very much coarser than the ground-tissue (exceptionally so).

Rings. Clear, the boundary a single row of small pores with wide-meshed tissue between them: contour regular.

Soft-tissue. In zones in the pore ring: Size 1 (ray-scale): also narrowly encircling the pores and in isolated irregular patches.

Flecks. The objects I take to be flecks are long, narrow, bands tapering each end, 0·25 mm. wide by 5–15 mm. long. They are dense and brown.

Pith.?

Radial Section. Pores long, conspicuous grooves having chambers to 0·5 mm. long, which are easily visible to the naked eye; a drop of resin in each. Rays prominent, purple flakes, a little deeper in colour than the ground. Neither the rings nor the soft-tissue are traceable.

Tangential Section. As the Radial, but not quite so light in colour and with more red streaks. The rays are minute, faint, brown lines about $\frac{3}{8}$ inch high.

Type specimen authenticated by the Forest Officer to the Government of British Guiana. From a log sent to the Colonial and Indian Exhibition.

No. 78. BLACK BEAN (of N. S. Wales.) Castanospermum australe. A. Cunn.

PLATE VI. FIG. 49.

Natural Order. Leguminoseæ.

Alternative Names. Bean-tree; Moreton Bay Chestnut in Queensland (5) and N.S.W. (85). Australische Kastanje in South Africa (51). Irtalie in N.S.W. (12).

Sources of Supply. Australia, Queensland, and New South Wales; introduced into South Africa.

Physical Characters, etc. Recorded dry-weight 35–46¼ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell none. Taste very faintly astringent. Solution with water or alcohol slightly brownish. Burns very well and rather noisily, embers glow in still air, heat expels a brown juice.

Grain. Coarse open. Surface bright; rays, pores, and soft-tissue dull, especially the latter.

Bark. "Glabrous, i.e. smooth, or nearly so" (85).

Uses, etc. "Very handsome, suitable for cabinet work" (85). "Prized by cabinet-makers and turners" (5). This wood has a superficial resemblance to the greyish kinds of Teak.

Authorities. Nilsson (85), p. 40. F. M. Bailey (5), p. 47. Hutchins (51).

Colour. Dark-brown to almost black. Sap-wood yellow.

Anatomical Characters. Transverse section:—

Pores. Prominent from their colour and size, Grade 2, not much variation except within the groups; very evenly distributed but a distinct zonal arrangement with a tendency to occasional oblique lines; few, 3–15 per sq mm.; mostly single, but in subdivided groups of as many as 12 pores.

Rays. Need lens, size 5–6, uniform; less than a pore-width apart, equidistant; stopped short by or running round the pores; numerous 9–13 per mm.; lighter in colour than the ground.

Rings. Vague, indicated by a change in the disposition of the pores and by a slightly less porous zone here and there.

Soft-tissue. Abundant and prominent; imbedding and sometimes winging the pores, or connecting a few concentrically or obliquely; light in colour.

Pith.?

Radial Section. Pores, prominent lines with light-coloured borders (in the dark wood): red or black contents. Rays just visible with the lens, minute, hoary dull flakes. No indication of the rings. Soft-tissue appears as hoary borders to the pores and equalling them in breadth.

Tangential Section. As the radial, but the rays are extremely minute, colourless, large-celled lines of one row of round cells.

Type specimens authenticated by R. F. Baker and F. M. Bailey.

No. 79. PARTRIDGE-WOOD. Andira sp.

PLATE VI. FIG. 50.

Natural Order. Leguminoseæ.

Alternative Names. Pheasant-wood : Sweet Partridge-wood : Red, Brown or Black Partridge-wood in England. Acapurajada (ragged bark) in Brazil (76). Angelin or Rebhühnerholz (68). (*See below.*)

Source of Supply. Brazil.

Physical Characters, etc. Recorded dry-weight 70¾–89½ lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell none. Taste faintly nutty. Burns badly : difficult to ignite : small sluggish flame. Solution with water deep reddish-brown : ditto with alcohol but fainter.

Grain. Coarse but even, the pores being filled up. Surface lustrous : the pores when full reflect the light.

Bark. Like a skin of shellac, $\frac{1}{32}$ inch thick, dark brown, brittle, closely adherent.

Uses, etc. Cabinet-making, turnery. Used as a substitute for Cocus (Brya Ebenus), and frequently sold for that wood.

Authorities. Holtzapffel (48), p. 99. Miers (76). Martin and Spitzbarth (68), p. 242. Wiesner (131), L. 12, p. 945.

Colour. Very dark brown, often nearly black heartwood, sharply defined from the ½–¾ inch wide, light brown or brownish-white sap-wood. Contour jagged and irregularly undulating.

Anatomical Characters. Transverse section :—

Pores. Readily visible from their colour and size, Grade 2, little variation except within the groups : collected somewhat into zones : the large ones mostly single, the small sub-divided or clustered radially in groups of 2–7 : numerous 14–50 per sq. mm. : irregularly and unevenly distributed : oval : filled with brown resin or gum.

Rays. Need lens, size 5–6, uniform : long, weak and avoiding the pores : equidistant, rather less than a pore-width apart : lighter in the solid, darker in thin section : numerous, 9–12 per mm. : hoary : not coarse-celled.

Rings. Apparently very clear ; doubtful, the lines of soft-tissue being too indefinite and not concentric with the other portions of the structure : contour gently undulating.

Soft-tissue. Very abundant and though fine, the most conspicuous feature : in thin, weak, hoary, concentric or anastomosing, thread-like lines, gently undulating : size about 3–5 (ray-scale) and about 5–8 per mm. but absent at intervals : fluctuating in width, widening at, but seldom completely surrounding the pores.

Pith. ?

Radial Section. Pores readily visible, but dark, inconspicuous lines usually completely filled with black contents. Rays minute, darker, shining flakes when cleft, lighter when planed. Soft-tissue needs lens : close fine lines (like " machine-ruling ") and also as more prominent borders to the pores.

Tangential Section. As the Radial, but the rays are minute, inconspicuous lines about 0·1 mm. high and the soft-tissue is scarcely traceable except alongside the pores.

Type specimens from commercial sources. Not authenticated. They agree sufficiently closely with the specimens of Andira in the Museum No. 1, Kew, to justify the assumption that they all belong to the same genus, but the whole of the species examined differ entirely from a specimen sent me from Jamaica by Messrs. Elder Dempster and Co. under the name of Andira inermis. See No. 80.

I incline to the view that this wood is Andira excelsa. H. B. and K. syn., Vouacapoua americana . Aubl., Geffroya racemosa. Poir., or Andira racemosa. Lam., called Vouacapoua, or Angelin in Guiana.

Miers, whose descriptions are excellent, has unfortunately mixed up the Systematic names in inextricable confusion. The description which tallies perfectly with the present species is referred to both A. Aubletti and to A. racemosa, besides which he gives cross references which leave one in doubt whether he means either of the two foregoing or A. amazonum, A. stipulacea, or A. retusa, all five being good species according to the *Index Kewensis.* We find the following :—

Under A. amazonum : " Angelim de Pará and Andara-Uichi probably that known in England as Partridge-wood."

Under A. racemosa " ibairiba. Tiss., A. stipulacea. Benth., Andaia-uichi (See Uichi)."

Under A. racemosa. Lam. : " Uichi : Uici : Andaia Uichi (See Angelim de Pará)."

Under Uichi : " Uixi. (see Andaia de Pará)," which latter he refers to A. retusa. H. B. and K.)

The description which he gives under the head of " Acapurajada from Pará " is the one which is much the nearest to the commercial Partridge-wood.

As it is quite possible that the proper name may be A. Aubletti,

it is as well to note the vernacular names mentioned by Saldanhada Gama as being current in Brazil, viz.:—Acapu, Epi de Blé Wacapou, Dacamaballi and Blackheart.

No. 80. ANGELIN. Andira inermis. Kunth. ?

PLATE VI. FIG. 57.

Natural Order. Leguminoseæ.

Synonyms. A. acuminata. Bth. A. grandiflora. Guill. et Perr. Geoffræa inermis. Sw.

Alternative Names. Yaba in Cuba (12). Bastard Cabban (76). Angelim, Cabbage-bark Tree, Lombricero all in Brazil (99). Bilge-water Tree. Not the Partridge-wood of the English market.

Sources of Supply. "Trop. America, West Indies, Brazil in the Northern Provinces of the Amazonas Region" (49).

Physical Characters, etc. Recorded dry-weight 33¾–40¼ lbs. per cu. ft. The latter figure is given by Miers (sp. gr., 644). The weights given by Boulger cannot apply to this species besides which it is not clear what he means by his figures as those cited for the specific gravity do not work out to the same as those representing lbs. per cu. ft. The former, 563–639, correspond with those given above, but his weights per cu. ft. (56·8 to 61·4) are very much out. Hardness Grade 6, compare English Beech or American Birch. Smell none. Taste astringent. Burns very well with a long, quiet, smoky flame: embers glow brightly in still air. Solution faint brown.

Grain. Fine and open, not very straight. Surface lustrous, silky, with a pretty play of light.

Bark. ?

Uses, etc. "A strong, durable wood for carpenter's work and ship-building—works well—of very large dimensions" (76).

Authorities. Boulger (15), Miers (74). Saldanha da Gama (99). Laslett (60), p. 297. Kew Guide (57).

Colour. Light, red, uniform. Sap-wood (?)

Anatomical Characters. Transverse section:—

Pores. Need lens, size 3–4: uniform: evenly distributed: in short, radial, sub-divided groups of 2–3 between the rays: occasionally with red contents: rather scarce, 0–20 per sq. mm.: roundish when single: few and usually widely separated.

Rays. Need lens, size 4–5, uniform: equidistant, a pore-width apart: firm, not avoiding the pores: numerous, 15–20 per mm.: lighter in colour than the ground: unevenly spaced and tapering to exceedingly fine ends.

Rings. Vaguely indicated: very doubtful.

Soft-tissue. Neatly encircling the pores, narrow, of the same colour as the rays.

Pith. The same colour as the rays, 3–4 mm. wide, hard. Cells very coarse, nearly as large as the pores of the wood.

Radial Section. Pores, very fine lines with narrow, hoary borders (lens). Rays, inconspicuous yet visible flakes. Rings not traceable. Soft-tissue (lens) bordering the pores. Pith, contrasting but little.

Tangential Section. As the Radial, but the rays are minute lines about 0·25 mm. high (need micro.).

This wood is quite unlike all other species of Andira that I have seen, but it tallies well with the description given by Miers.

Type specimen sent me by Messrs. Elder Dempster and Co., authenticated by Sir Thomas Hughes.

No. 81. MORA. Dimorphandra Mora. Benth.

PLATE VI. FIG. 52.

Natural Order. Leguminoseæ.

Synonyms. Mora excelsa. Baill. and Benth. Dimorphandra excelsa. Baill. D. guianensis. Baill.

Alternative Names. Moraballi in British Guiana (78). Moreira in the Amazonas region (76).

Source of Supply. Tropical America.

Physical Characters, etc. Recorded dry-weight, 67½–68½ lb. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell none, taste bitterly astringent, but it is not perceptible until the shavings have remained in the mouth for a time. Burns well with much crackling. Solution the colour of brown brandy.

Grain. Very coarse, but the pores are usually filled with Thyloses. Surface lustrous.

Bark. ?

Uses, etc. "Very durable, more so than Teak, . . . ship-building, . . . tough, strong, polishes well, star-shake frequent, . . . recommended for the larger parts of ships and buildings, also piles: rated first-class at Lloyd's" (60). See Laslett for mechanical tests. Schomburghk gives it unstinted praise. "Does not splinter, resists dry-rot. There are three varieties, the Red, the White and Mora bucquia: the latter is not durable" (76). Mora does not resist the Teredo, see a specimen in the Museum No. 1, Kew, which is honey-combed by them. It turns badly, planes well and smoothly, is hard to saw, but splits evenly. It is a handsome wood but is sometimes marred by lines of white secretion. It is worthy of more attention. Mora may be met with in logs of "18–35 feet long by 12–20 in. square. It is the largest tree of British Guiana, and grows to

a height of as much as 150 feet. When very large it is generally hollow" (8).

Authorities. Laslett (4), p. 275. Kew Guide (57), pp. 43, 38. Miers (76). McTurk (78), No. 55. Holtzapffel (48), p. 94.

Colour. Dark brown or dark reddish-brown streaked with white or brown lines. Heart-wood sharply defined from the yellowish or light brown sap-wood.

Anatomical Characters. Transverse section:—

Pores. Very prominent, giving the wood a "caney appearance" (60): size 2, little variation: evenly distributed over the whole surface: few, 17–40 per sq. mm.: in groups of 1–6 pores but mostly in threes, irregularly or radially subdivided: groups enclosed in patches of soft-tissue which connect two or three of them together: occasionally contain resin or gum.

Rays. Need lens, size 5, uniform: equidistant, about the width of a large pore apart, weak but scarcely avoiding them: numerous, 5–7 per mm.: denser than the ground and of nearly the same colour as the soft-tissue.

Soft-tissue. Prominent: abundant in broad patches imbedding and connecting the pores in an oblique or concentrically-waved fashion.

Pith. ?

Radial Section. Considerably lighter in shade than the Trans. Pores very prominent, light brown when bordered by soft-tissue or chalky when filled with Apatite. Soft-tissue readily visible as hoary borders to the pores but scarcely prominent.

Tangential Section. The pores give the wood the appearance of that of a Palm, being very prominent. Rays minute brown, spindle-shaped lines about 0·5 mm. high. Soft-tissue the chief feature, affording much contrast of colour and occupying at least half the surface of this section.

Type specimens from a log sent by the Government of British Guiana to the Colonial and Indian Exhibition.

No. 82. IROKO. Sp. unknown (see below)

PLATE VI. FIG. 53.

Natural Order. Leguminoseæ.

Source of Supply. West Coast of Africa: Lagos.

Physical Characters, etc. Recorded dry-weight 39½ lbs. per cu. ft. Hardness Grade 6, compare Oak. Cleaves very easily. Smell none, but the sawdust is very irritating to the nostrils. Taste extremely vapid. Burns badly: supports a flame with difficulty: embers glow in still air: much snow-white ash: no resin or gum expelled by heat: no smell. Solution faint, clear yellow.

Grain. Very coarse and open. Surface lustrous and satiny.

Bark. ?

Authority (as to the vernacular name) the Governor of Lagos, from whom the type specimen was received. This is not the wood mentioned by Sir A. Moloney (Kew Bull., Feb., 1891, p. 41), which is Chlorophora excelsa.

Colour. Heart-wood deep brown. Sap-wood. ?

Anatomical Characters. Transverse section :—

Pores. Readily visible, large, size 1–2, few, 0–6 per mm. : little variation in size except in the groups : evenly distributed, connected by the soft-tissue into short, undulating, often interrupted festoons : single or in short, sub-divided, radial groups or clusters of as many as five pores : some with brown contents.

Rays. Visible though fine, size 5–6, uniform : equidistant, a pore-width or less apart : many 4–8 per mm. : sometimes avoiding the pores, weak : considerably lighter in colour and denser than the ground-tissue.

Rings. Visible but not conspicuous : boundary a clear, fine line of hoary soft-tissue without contrast in the density of the ground-tissue.

Soft-tissue. Very abundant and prominent, the chief feature. In light-brown, interrupted and waved (but scarcely cruciform) festoons imbedding and connecting the pores, composed of parallel rows of cells radially disposed.

Pith. ?

Radial Section. Pores, very prominent and coarse often running out of parallel. Rays, readily visible by difference of reflection not of colour : brown, shining almost metallic flakes. Rings, very obscure, traceable as continuous, hoary lines. Soft-tissue prominent as hoary continuations of the pores and as the boundary-line : not equally prominent in all lights.

Tangential Section. As the Radial, but the rays appear as inconspicuous lines (lens) about 1·0 mm. high.

No. 83. COCUS or COCOS WOOD. Brya Ebenus. DC.

PLATE VI. FIG. 54.

Natural Order. Leguminoseæ.

Synonyms. Amerimnum Ebenus. Sw. Amerimnon Ebenus. Sw. Aspalathus Ebenus. Linn. Brya leucoxylon.

Alternative Names. Green Ebony : West Indian Ebony : Jamaica Ebony : Cocoa-wood : Brown Ebony. Chichipate (12). Granadillo : Granillo, and also a number of names of Spanish origin supposed to refer to this wood, see Holtzapffel, (29).

Lignum-vitae: Billy-web in Honduras (46). American Ebony (131). Not the Coco-wood of Gamble (48), nor Kokkra-wood (Kew. Mus.).

Sources of Supply. Tropical America and the West Indies, chiefly Jamaica.

Physical Characters, etc. Recorded dry-weight 77–87 lb. per cu. ft. Hardness Grade 1, compare Ebony. Smell or taste none. Burns well, ignites slowly: embers glow in still air. Solution with water none: with alcohol brown.

Grain. Very fine, dense and even. Surface dull and cold to the touch.

Bark. About $\frac{1}{8}$ in. thick, light grey, brown or white, peels in strips like bast: fissured and laminated.

Uses. "Turnery, flageolets, inlaying, cabinet-making, turnery" (60). Durable (64). Planes smoothly, a choice turner's wood but high in price.

Cocus is often confused with Partridge-wood, which is frequently substituted for it.

Authorities. Kew Cat. (57), p. 41. J. Leman (64). Royle (in Holtzapffel) (48), p. 81. Wiesner (131), L. 12, p. 924. Laslett (60), p. 206.

Colour. Heart-wood dark, rich brown almost black: very sharply defined from the sulphur-yellow sap-wood, which is about $\frac{1}{2}$–$\frac{5}{8}$ inch wide.

Anatomical Characters. Transverse section:—

Pores. Need lens, rather fine, size 4, slightly variable: scattered and rare, 1–7 per sq. mm.: appear of a lighter brown in the brown bands, almost imperceptible in the black ones: in short, sub-divided groups.

Rays. Need lens, very fine, size 6, uniform: equidistant: less dense than the ground-tissue: very numerous, 7–9 per mm.: brown but scarcely discernible in the solid wood in the black zones: a pore-width or less apart, rarely if ever avoiding them.

Rings. Apparently clear but the boundary is not perceptible with the lens: many alternate bands of rich brown and black which do not indicate the year's growth.

Soft-tissue. In concentric lines as fine as the rays and equally abundant making a network with them: prominent with lens in the brown zones: also encircling the pores.

Radial Section. Considerably lighter in shade than the Transverse section, often purplish-brown. Pores, very fine, cellular lines containing minute drops of blackish resin (not to be confused with the blackish lines of soft-tissue, see below). Rays, minute almost indistinguishable flakes. Rings not perceptible, but the zones of colour clear; black alternating with brown or brownish-purple. Soft-tissue, visible only in the zones corres-

ponding to the black zones in Transverse section, appears as extremely fine, black, parallel lines.

Tangential Section. As the Radial, but the rays are imperceptible even with lens: about 0·2 mm. high. Soft-tissue not so readily visible but the pores are more prominent. Plate XXI. Fig. 172.

Type specimens from commercial sources. Not authenticated but checked by the specimens in the Museum No. 1, Kew. Wiesner, whose description exactly corresponds with this wood, calls it Inga vera. Willd., but as it is quite unlike other species of Inga described by Nördlinger and as the Kew specimen is doubtless as authentic as his, I adhere to the name of Brya ebenus.

No. 84. HOOBOOBALLI. Stryphnodendron guianense. Benth. (see note.)

PLATE VII. FIG. 55.

Natural Order. Leguminoseæ.

Synonym. Mimosa guianensis. Aubl.

The vernacular name may be met with variously spelled. Cassie (3).

Physical Characters, etc. Recorded dry-weight $55\frac{3}{4}$ lb. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell none. Taste astringent. Solution pinkish-brown. Burns well, embers glow in still air: the ash is left in the form of a skeleton of the soft-tissue.

Grain. Moderately fine and open. Surface lustrous, but the soft-tissue, which is a feature, is dull.

Bark. "Contains a sticky gum" (78). The surface of the log after the removal of the bark is striated like the surface of cane.

Uses, etc. "Cabinet-making and all purposes where it is exposed to the action of water: will outlast almost any other wood at the bottom of a boat. A wood of great beauty which takes an excellent finish. A tree of the average height of 100 feet, which will square 20 inches free of sap-wood" (78). This wood deserves attention on account of its pretty figure and other good qualities.

Authorities. McTurk (78), No. 36. Stone (117). *Imp. Inst. Jour.* No. 70, p. 266.

Colour. Whitish-brown heart-wood streaked with blackish or brownish concentric bands which approach and recede from each other in loops in Transverse section, and form lines in the Radial section. Sap-wood about 1 inch wide, white, defined from the heart-wood.

Anatomical Characters, etc. Transverse section :—

Pores. Readily visible though not prominent, size 2, rather coarse, little variation except in the groups : evenly scattered in groups of as many as 33 pores, radially disposed, sometimes two-rowed : rarely isolated pores : few, 0–38 per sq. mm. according to the number in a single group : some filled with resin or gum.

Rays. Need lens, size 4–5, uniform : straight, but avoiding the larger groups or interrupted by them : many, 7–10 per mm. : sometimes much less than the width of a pore-cluster apart, being unevenly spaced.

Rings. Doubtful as the concentric lines of soft-tissue often cross the radial pore-groups without interrupting them. The dusky or brown bands are quite independent of the structure.

Soft-tissue. Abundant, encircling the pores and also in close regular lines (about size 3), crenate between the rays and wavy in contour, composed of conspicuously large (micro.) isolated cells, about size 6 and 3–5 per mm. : brownish. The lines form a beautiful reticulation with the rays and are of the same colour.

Pith. ?

Radial Section. The dusky zones appear as prominent lines. Pores, large and clear but not prominent. Rays, small and pronounced by reason of their dullness and whiteness. Rings not traceable : the dusky lines do not coincide with the structure. Soft-tissue visible as fine whitish lines even with the unaided eye.

Tangential Section. As the Radial, but apparently very unlike as the dusky lines lose their character entirely and thus are apt to deceive. The rays are fine, white lines about 2.0 mm. high, the soft-tissue is not so fine and the lines are not so close together.

Type specimen from a log sent to the Indian and Colonial Exhibition by the Government of British Guiana. I suspect an error in the nomenclature as the structure is not that of a Leguminous wood. It resembles rather that of some Meliaceous woods such as Dysoxylon. I place it here hoping that someone on the spot in British Guiana may clear the matter up.

No. 85. COURBARIL PLUM. Hymenœa Courbaril. Linn.

PLATE VII. FIG. 56.

Natural Order. Leguminoseæ.

Synonyms. H. aminifera. Stokes. H. resinifera. Salisb. The generic names Courbari and Courbaril are synonymous with Hymenœa.

Alternative Names. Courbaril : Locust. Jetahy : Jetahy-

accu in N. and Amazonas Prov. Brazil (76). Simiri and K'wannarri (representing two different qualities), in British Guiana (78): also Locust Gum (12). Pois confiture: Gomme animée: Jatoba in Barbadoes, and Jatai in Brazil (105). Leathery-leaved Locust-tree: West Indian Locust-tree in the West Indies. Quapinole (131). Locustrier: Algarroba, in Rio de Janeiro (99).

Sources of Supply. Tropical South America.

Physical Characters, etc. Recorded dry-weight, 33¼–57½ lb. per cu. ft. The lower figure is taken from a tainted or unsound sample. McTurk calls the wood "hard": my specimen is not reliable. Smell none. Taste faintly astringent. Burns well: embers glow in still air. Solution with water yellowish-brown.

Grain. Rather coarse and open, but as there is a large proportion of wood without pores the whole has a close-grained appearance. Surface dull, the ground-tissue the brightest portion.

Bark. Dark brown with shallow fissures, as hard as the wood: the rays continued into the bark, readily visible. It can be detached from the log entire and is employed by the Indians for making bark canoes.

Authorities. Nördlinger (86), vol. v. p. 34. McTurk (78), No. 37. Miers (76). Schomburgk (105). Kew Cat. (57), 37. Laslett (60), p. 296. J. Smith, pp. (111), 131, 136. Wiesner (131), Lief 6, p. 85. Saldanha da Gama (99).

Colour. Heart-wood light brown streaked with darker brown, fairly well defined from the yellow or dirty-white Sap-wood, which is "about 4 inches wide" (78).

Anatomical Characters. Transverse section:—

Pores. Readily visible, size 2, uniform in size within the limits of each ring, but increasing from the pith outwards as the tree ages: very evenly distributed: few, 5–13 per sq. mm.: single or in sub-divided groups of 2–7 together, radial or nested: sometimes filled with yellowish or ruby gum.

Rays. Just visible, medium, size 4–5, uniform: equidistant: undulating, scarcely avoiding the pores: very long, rarely tapering outwardly and very gradually inwardly: slightly denser than the ground-tissue: numerous, 4–6 per mm.: yellowish: a pore-width or less apart.

Soft-tissue. Abundant at times. In concentric lines or bands, often forming complete circles, sometimes as narrow as the rays, at others as broad as the pore-groups which are imbedded in them.

Pith. Small, about 1 mm. wide with four wings or lobes: reddish or yellowish.

Radial Section. Pores dark brown, rather coarse. Rays faint, almost colourless flakes. Rings imperceptible.

Tangential Section. As the Radial, but the pores are scarcely so coarse. The rays are spindle-shaped lines, just visible by their numbers appearing something like those of Mahogany.

Type specimen authenticated by the Forest Officer to the Government of British Guiana. The figure from a section by Nördlinger.

No. 86. WASHIBA. Parinarium sp. (probably guianense). Aubl.

PLATE VII. FIG. 57.

It is upon the assumption that this is the correct name that the various references have been compiled.

Natural Order. Rosaceæ.

Synonyms. Ferolia guianense. Aubl. F. variegata, Lam.

Alternative Names. Waciba: Bow-wood. Ferolier: Bois Satiné. Bois Férole (3).

Source of Supply. Guiana. Guadeloupe.

Physical Characters, etc. Weight, about 55 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Solution with water faint brown.

Grain. Moderately fine: open. Surface, rather lustrous: Pores dull with some shining resin-drops: rays dull but inconspicuous.

Bark.?

Uses, etc. "Bows, fishing-rods, exceedingly tough and elastic. Rare. Will square 30 inches free of sap-wood, by 120 feet long" (78).

Authorities. McTurk, No. 54 (78). Aublett (3). Wiesner (131), L. 6, p. 80.

Colour. Heart-wood rich reddish-brown "a beautiful red splashed with yellow, satiny" (3), well but not sharply defined from the brownish or yellowish-white sap-wood, which is "two feet thick to one of heart, white, hard, heavy and compact" (3).

Anatomical Characters. Transverse section:—

Pores. Prominent, size 2, little variation: evenly and widely scattered: few, 0–10 per sq. mm.: single, sub-divided a few threes and sometimes as many as seven in a group, radially disposed or clustered: many with red contents.

Rays. Need lens: size 6 (or rather larger), uniform: equidistant: weak but not avoiding the pores though often interrupted by them: much less than the width of a large pore apart: long: denser than the ground: extremely numerous, 11–13 per mm.: the same colour as the ground but lighter.

Rings. Doubtful, but if indicated by the lines of soft-tissue

then very definite and clear with the lens, but they display no harmony with the arrangement of the pores.

Soft-tissue. Abundant in concentric lines, about 120 per inch: size equal to 4 (ray scale): contour weak: otherwise well-rounded: cells coarse, equal to size 6 (pore scale): brown: very distinct and characteristic in the transparent section, though sometimes reduced to vanishing point.

Radial Section. Pores prominent though rare, usually dull often with shining drops: rays minute, dull flakes or lines: difficult to see: light coloured. Soft-tissue visible as fine, whitish lines very close together.

Tangential Section. As the Radial, but the pores are much finer as they are cut through the narrow way. Rays minute, whitish lines upon the limit of vision about 0·1 mm. high. Soft-tissue not so coarse or close together.

Type specimen authenticated by the Forest Officer to the Government of British Guiana.

The structure of this wood agrees closely with that of Parinarium Nonda, but as the specimen was not accompanied by its systematic name I cannot vouch for more than the genus.

No. 87. Pygeum africanum. Hook.

PLATE VII. FIG. 58.

Natural Order. Rosaceæ.

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 57½ lbs. per cu. ft. Hardness Grade 5, compare English Elm. Smell or taste none. Burns well and quietly: an orange-coloured juice is expelled by heat: embers glow in still air: no aroma. Solution colourless: a copious red ppt. with potash. Neither water nor alcohol will completely bleach the wood. In order to do this it needs to be boiled in potash.

Bark. ? There is a thin, scaly, chocolate-brown skin about $\frac{1}{64}$ inch thick upon the outside of my specimen which may be the bark or only an inner layer.

A wood of fine texture which planes and saws exceptionally smoothly and well.

Colour. Uniform red passing gradually over into the light brown sap-wood, which is about 4 inches wide.

Anatomical Characters. Transverse section:—

Pores. Visible, size 4–5, little variation: uniformly scattered, single or in small radial sub-divided groups of 2–4 between the rays: 10–25 per sq. mm.

Rays. Need lens or just visible, size 5–6, uniform though apparently of two sizes: stout, tapering rapidly to fine threads

both ends : red : a pore-width apart : occupy half the transverse surface : 10–14 per mm. (i.e. "middles and ends" together).

Rings. Vague.

Soft-tissue. Encircling the pores.

Pith. ?

Radial Section. Pores, rather coarse scratches containing drops of reddish gum at intervals. Rays, prominent though small, dark red flakes.

Tangential Section. As the Radial, but the rays are just visible, rather broad, spindle-shaped lines about 1 mm. high.

Type specimen authenticated by the Forest Officer to the Government of Natal. The structure is quite unlike that of any of the European woods belonging to the same natural order.

No. 88. PEAR. Pyrus communis. Linn.

PLATE VII. FIG. 59.

Natural Order. Rosaceæ.

Synonyms. P. Pyraster. Linn.

Sources of Supply. Europe : Western Asia : introduced into most temperate climates.

Physical Characters, etc. Recorded dry-weight 44–52 lbs. per cu. ft. Hardness Grade 6, compare Apple or Beech. Smell or taste none.

Grain. Fine, the pores just visible. Surface dull.

Bark. $\frac{1}{8}$–$\frac{3}{8}$ inch thick, smooth, silvery-grey or yellowish-when young with prominent lenticels : breaking later into rectangular scales and becoming rough when old.

Uses, etc. Turnery, carving. Difficult to split, tough : durable in dry places. "Works well in all directions, liable to twist : shrinks $\frac{1}{6}$ of its original bulk when green. Wood-engraving, musical instruments : takes a black stain well and then resembles Ebony." (69)

Authorities. Nördlinger (87), p. 534. Ditto (86), vol. iii. p. 58. Laslett (60), p. 165. Hartig (42), pp. 31 and 41. Schwartz (106), p. 484. Westermeier (31), p. 10. Holtzapffel (29), p. 99. Mathieu (129), p. 167. Wiesner (131), L. 12, p. 918.

Colour. Reddish-brown sap-wood. Heart-wood only in old trees and then apparently the result of disease.

Anatomical Characters. Transverse section :—

Pores. Need lens, fine, size 5, little variation : slightly smaller in the Autumn wood : equally crowded throughout the ring : very numerous, 200–300 per sq. mm. : single or in groups of 2–5 : loose strings may appear to be formed here and there ("wurmformig," 86).

Rays. Just visible in certain lights : fine to medium, size 4–5 :

equidistant, a pore-width or more apart: very numerous, 15–20 per mm.: not quite straight but firm, not avoiding the pores: they occupy nearly half the transverse section.

Rings. Very clear: the boundary a line of contrast and usually a fairly regular single line of pores in the Spring wood: contour rather uneven.

Soft-tissue. Single cells and strings of cells.

Pith. Small, about 1–2 mm. diameter, roundish: white to brown: hard.

Radial Section. The pores need the lens, very fine lines, difficult to make out. The rays very small, inconspicuous brownish flakes. The rings are very clear but not prominent lines.

Tangential Section. As the Radial, but the rays are colourless, vertical lines imperceptible with the lens.

Type specimens from commercial sources: also from trees known before felling.

No. 89. APPLE. Pyrus Malus. Linn.

PLATE VII. FIG. 59.

Natural Order. Rosaceæ.

Synonyms. Pirus acerba. D.C. Malus communis. Poir.

Alternative Names. Crab: Crab-apple: Wild Apple: Crab-tree.

Sources of Supply. Europe: Western Asia: Himalayas.

Physical Characters, etc. Recorded dry-weight 41–50 lbs. per cu. ft. Hardness Grade 6, compare Beech or Walnut. Smell and taste none. Burns very well and quietly, ignites readily, embers glow in still air. Solution with water or alcohol colourless.

Grain. Very fine, close and dense. Surface not lustrous: the pores may be seen shining with lens.

Bark. Thin, ¼ inch thick, rough, wrinkled, bright: brownish or purplish-black when young: scaling later in rectangular scales.

Uses, etc. Turnery. Not durable. Splits with great difficulty. Rarely of large size, usually met with as small logs or underwood.

Authorities. Nördlinger (87), p. 534. Ditto (86), vol. iii. p. 59. Schwartz (106), p. 485. Hartig (42), p. 29. Mathieu (69), p. 173. Wiesner (131), L. 12, p. 919.

Colour. Heart-wood quite uniform, light reddish-brown not sharply defined from the brownish or reddish-white sap-wood which is about 12–20 rings wide.

Anatomical Characters. Transverse section:—

Pores. Need lens, fine, size 5, little variation: evenly distributed in groups of from 2–5 occupying the whole ring: very numerous, 100–200 per sq. mm.

Rays. Need lens, fine to medium, size 4–5: somewhat irregularly spaced, a pore-width or more apart: not long: slightly undulating, tapering gently at both ends: little if any denser than the ground-tissue: difficult to see in a transparent section: very numerous, 6–8 per mm.: "10–13" (131): weak or waved, but scarcely avoiding the pores.

Rings. Very clear: the boundary a fine clear line of dense Autumn wood: contour undulating.

Soft-tissue. In occasional isolated cells or lines.

Pith. Small, 1–3 mm. diameter, round or lobed, nearly as hard as the wood.

Radial Section. Pores minute, colourless lines sometimes shining. Rays, minute flakes slightly darker than the ground-tissue. Rings clear but the very fine boundary lines a little darker than the remainder of the ring.

Tangential Section. As the Radial, but the rays are minute, almost imperceptible vertical lines; about 0.5 mm. high.

Type specimens from commercial sources and also from trees known before felling.

No. 90. MOUNTAIN ASH. Pyrus aucuparia. Ehrh.

PLATE VII. FIG. 59.

Natural Order. Rosaceæ.

Synonyms. Sorbus aucuparia. Linn. (Pirus = Pyrus).

Alternative Names. Rowan tree: Fowler's Service Tree: Quicken Tree. Cochêne: Sorbier des Oiseaux (69). Eberesche (87).

Sources of Supply. Europe: Madeira: N. and W. Asia: N. America.

Physical Characters, etc. Recorded dry-weight 35½–48½ lbs. per cu. ft. Hardness Grade 6, compare Beech or Apple. Smell or taste little if any. Burns well: embers glow in still air. Solution with water or alcohol colourless.

Grain. Extremely fine, close and dense. Surface bright: "Satiné" (69).

Bark. Reddish-brown, smooth, shining. Grey later, shining only here and there where the original epidermis remains.

Uses, etc. "Turnery, tools, frictional parts of machines" (69). "Wood-engraving, tools especially screw, for presses" (70). "Furniture, turnery and carving: flexible: not durable" (129). Splits unevenly and with difficulty.

Alternative Names. Black Cherry: Wild Black Cherry (49): Späte Traubenkirsche (131).

Sources of Supply. North America, Southern Canada and Eastern U.S.A. (49).

Physical Characters, etc. Recorded dry-weight, 36½ lbs. per cu. ft. Hardness Grade 7, soft, compare Deal, Alder, English Birch. Smell or taste none. Burns well with a lively flame: embers glow in still air. Solution with water faint brown; with alcohol afterwards, faint red.

Grain. Very fine but open. Surface bright: the pores the dullest, the rays the brightest part.

Bark. "Smooth, close, the outer layer peeling off in strips transversely—breaking into small hard scales of dark colour and giving old trunks a very characteristic appearance" (49).

Uses, etc. "One of the most valuable and popular of our native woods (U.S.A.) for interior finishing and furniture" (49.)

Authorities. Hough (49), pt. ii. p. 17. Wiesner (131), L. 6, p. 80. Sargent (100), p. 68.

Colour. Uniform dark red. Sap-wood light yellowish (49).

Anatomical Characters. Transverse section:—

Pores. Need lens, fine, size 5, little variation: evenly distributed, but a single line of pores following the boundary of the ring: mostly single or in groups of from 2–3 pores: numerous 65–115 per sq. mm.: occasionally drops of dark red gum especially in the pore-ring.

Rays. Very sharp and clear: size 4, medium, uniform: almost equidistant: gently curved, not avoiding the pores: many, 4–6 per mm.: long, tapering both ends, much denser and much lighter than the ground-tissue: more than a pore-width apart.

Rings. Clear: boundary a fine, dense line of Autumn wood usually accompanied by a fairly continuous row of pores in the early Spring wood.

Soft-tissue. Isolated cells only: in considerable quantity but scattered. (In certain species of Prunus it forms conspicuous and characteristic flame-shaped patches.) Rows of gum-galls resembling those of the Eucalypti occur here and there.

Pith. ?

Radial Section. Rather lighter in shade than the above. The pores are fine lines (need lens) containing frequent drops of gum which are more easily seen when moistened. The rays are small, light-coloured flakes visible in certain lights: lustrous. The rings are scarcely traceable.

Tangential Section. As the Radial, but the pores are visible to the naked eye as a fine, dull shading. The rays need lens, but are broad, spindle-shaped, vertical lines about 1·0 mm. high,

of the same colour as the soft-tissue. The rings are faint loops or bands of slightly larger pores : rather indefinite.

Type specimens from commercial sources and also authenticated by Romeyn B. Hough.

No. 93. CANADIAN CHERRY. Prunus emarginata. Walp.

PLATE VII. FIG. 60.

Natural Order. Rosaceæ.

Synonym. Cerasus emarginata. Dougl.

Sources of Supply. United States of America, British Columbia.

Physical Characters, etc. Recorded dry-weight, 35½ lbs. per cu. ft. Hardness Grade 6, compare Beech. Taste or smell none. Burns well : embers glow in still air : a copious yellow juice is expelled by heat. Solution colourless : the alcoholic solution yields a slight ppt., with potash. Surface lustrous, especially in radial section.

Grain. Fine, open and straight.

Bark. ?

Authorities. Macoun (66), p. 125. Sargent (100), p. 67.

Colour. Heart-wood brownish : uniform. Sap-wood ?

Anatomical Characters. As those of Prunus serotina, No. 92, with the following variations :—

Pore-ring. *Not* a single line and *not* sharply marked off from the later pores : no red gum anywhere.

Rays. Only just visible to good sight : size 5, and 5–6 per sq. mm. : tapering very little : a trifle lighter in colour than the ground.

Radial Section. Rings clearly traceable : rays lustrous, especially when weathered, but there is little contrast of colour.

Tangential Section. The rays are not visible with the lens in the solid section except when moistened.

Type specimen authenticated by Hough.

No. 94. RED ELZENHOUT. Cunonia capensis. Linn.

PLATE VII. FIG. 62.

Natural Order. Saxifrageæ.

Alternative Names. Red Alder : Red Els : Rood Els or Elze : Red Cedar (59) : Umgwasube (61).

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight, about 46½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell

none. Taste slightly insipid. Burns well and quietly, embers glow in still air. Solution with water clear red resembling the colour of the wood.

Grain. Extremely fine though open. Surface scarcely bright : rays dull : pores shining : ground a little brighter.

Bark.? (The surface of the log under the bark is finely striated).

Uses, etc. "Cabinet making, turnery, wheels : durable in the wet. A tree from 15–60 ft. high by 1½–2 ft. diam." (57). An excellent turner's wood : well worth importing.

Authorities. Kew Guide (59), p. 33. Laslett (60), p. 304. Ditto (61), p. 438. Cape S.A. (19).

Colour. Red like Apple-tree wood but deeper. Sap-wood similar but lighter, not defined from the heart-wood.

Pores. Just visible from their lighter colour, size 4, little variation : evenly distributed : sometimes arranged in loose strings : a narrow zone poor in pores : numerous, 40–50 per mm. : single, rarely grouped, occasional twos and threes, not subdivided ; longish-oval.

Rays. On the limit of vision, size 5–6 : in appearance two sizes, but the smaller are the much attenuated ends of the larger, giving the impression that there are many small between the large ones : "ends" much less than a pore-width apart, 19–27 per mm. : "middles" a large pore-width apart, 3–5 per mm. : very lax and large-celled.

Rings. Fairly clear, the boundary a narrow band of darker and denser wood : contour gently undulating.

Soft-tissue. In scattered single cells.

Pith. ?

Radial Section. Quite uniform in colour : pores scarcely visible : rays rather prominent from their deeper colour, though small : they make a pretty silver-grain : rings just traceable.

Tangential Section. As the Radial, but the rays appear as large, red, spindle-shaped lines of coarse, round cells filled with red gum : about 0·5 mm. high ; rings a little clearer where the loops show broadly.

Type Specimen. A portion of a log sent to the Colonial and Indian Exhibition.

No. 95. CORKWOOD. Weinmannia rubifolia. Benth.

PLATE VII. FIG. 63.

Natural Order. Saxifrageæ.

Alternative Names. Marara (85) in N.S.W., not in Queensland. It is not the Corkwood of Dominica (Ochroma Lagopus)

nor Duboisia myoporoides. R. Br., sometimes called Corkwood in N.S.W. and Queensland.

Sources of Supply. Australia, New South Wales and Queensland.

Physical Characters, etc. Recorded dry-weight, 48¼ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell none. Taste insipid. Solution with water faint amber. Burns well and quietly with little smoke and an agreeable smell : heat expels a copious gum.

Grain. Extremely fine but open. Surface scarcely bright : pores shining. Rays and ground dull.

Bark. "Light grey" (85).

Uses, etc. "A tree attaining the dimensions of 150 ft. in height by 3 ft. in diameter. : wood close-grained and tough, but easily wrought. Highly spoken of by those who have used it (85)."

Authority. Nilson (85) p. 124.

Colour. Light brown or pink, quite uniform.

Pores. Upon the limit of vision, size 4–5, little variation : evenly distributed, occasionally a narrow zone poor in pores : numerous, 40–90 per sq. mm. : arranged radially : many single, pairs, and subdivided in groups of as many as 8 : oval : empty.

Rays. Upon the limit of vision, size 5–6 : in appearance two sizes, but the smaller are the attenuated ends ; uniform ; equidistant but apparently many small between the large ones ; "ends" a pore-width apart ; "middles" much more : together about 12 per mm. : very lax and large-celled.

Rings. Very faint, by no means clear : the boundary only occasionally visible as a vague, darker band or a zone poor in pores : much less distinct with lens than appears to the naked eye.

Pith. ?

Radial Section. Pores visible but very fine and inconspicuous : no contrast : the rays need the lens and are slightly pinker, minute, inconspicuous flakes : the rings are just traceable with care.

Tangential Section. As the Radial, but the rays are minute, inconspicuous, pinkish lines about 0·2 mm. high.

Type specimen authenticated by the Sydney Technological Museum.

No. 96. KAMAHI. Weinmannia racemosa. Linn.

PLATE VII. FIG. 63.

Natural Order. Saxifrageæ.
Source of Supply. New Zealand only.
Alternative Names. Towhai, Kamai (91).

much disputed" (100). "Warps and twists badly if not steamed immediately after sawing into planks" (49). "Not strong, rather tough, compact, its great economic value is scarcely appreciated on account of the difficulty experienced in perfectly seasoning it. Inclined to shrink and warp badly in seasoning, susceptible of a beautiful polish: building timbers, plates, boarding and clap-boards, cabinet-making, veneering and street-paving" (100). Very resilient and withstands traffic well from that reason, equalling even much harder woods: silent and smooth but extremely perishable from decay, creasoting being absolutely essential if it is to be used for street-paving. Liable to crack in the sun—always more or less defective in the centre. In bad repute in England owing to inferior wood being used without creasoting, thus obscuring its many excellent qualities. Only used for the commonest class of furniture.

Authorities. Nördlinger (87). Hough (49), pt. iii. p. 24. Sargent (100), No. 39. Lefroy (63). Boulger (17).

Colour. Red or reddish-brown, excentric heart-wood well defined from the cream-coloured or whitish sap-wood. Usually marked with smoky streaks. Dull brown in inferior grades.

Anatomical Characters. Transverse section:—

Pores. Need lens, rather fine, size 4, little variation: evenly crowded throughout the ring: in occasional groups of 2–3 or apparently crowded into straggling lines: very numerous, 160–200 per sq. mm.: sometimes a few containing gum

Rays. Just visible in certain lights, medium, size 4, uniform: straight, not avoiding the pores, a pore-width or less apart: denser than the ground-tissue: numerous, 8–9 per mm.: rather short, frequently tapering: brown.

Rings. Clear, not prominent: boundary, a fine line or zone of Autumn wood, sometimes very clear, at others difficult to see: the smoky zones are independent of the rings: contour uneven.

Soft-tissue. In many isolated cells.

Flakes. Rare, long, narrow, yellow—of a lighter colour than the wood.

Pith. ?

Radial Section. Innumerable, fine, shining lines, many containing drops of gum. Rays inconspicuous, fine flakes of the same colour as the ground-tissue. Rings rarely traceable, though the smoky zones are frequently prominent. Flakes appear as very fine lines.

Tangential Section. As the Radial, but the rays are imperceptible with lens: about 0·5 mm. high, not spindle-shaped, but rather blunt. Very beautiful objects in the solid under the microscope. The smoky zones widen out in this section.

Type specimens authenticated by Hough.

No. 98. JARRAH. Eucalyptus marginata. Sm.

PLATE VIII. FIG. 65.

Natural Order. Myrtaceæ.

Synonyms. E. floribunda. Hueg. E. Mahagoni. F. v. M. E. hypoleuca. Schau.

Alternative Names. Mahogany Gum. Australian Mahogany. Yarrow-tree (42). Curly Jarrah, in Victoria (46).

Sources of Supply. Western Australia, New Zealand, Victoria.

Physical Characters, etc. Dry weight, 50½–64 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell or taste none. Burns indifferently, embers soon die out and leave the carbonized wood. Heat expels drops of resin or gum. Ash black. "One of the least inflammable woods" (42). Solution with water or alcohol brownish. Commercial form, chiefly paving blocks or planks from which they are cut.

Grain. Course, open—*sinuous.* Surface rather dull. The ground tissue the brightest portion, the pores and rays very dull.

Bark. Deeply fissured, dark grey or brownish, fibrous, persistent, ¼–⅜ inch thick, of two layers, the outer fibrous, the inner compact : grey.

Uses, etc. "Good for paving, piles, sleepers, ship-building and for purposes where it is exposed to the attacks of the teredo, chelura or white ants." Durable under all circumstances properly seasoned. Liable to be unsound in the heart and to contain "gum-veins" or cavities. Becomes harder with age. "It appears imperishable, excellent qualities for paving : apt to warp if not well selected" (28).

Authorities. J. Ednie-Brown (21), p. 10. Laslett (4), p. 231. Petsch (28), p. 125. F. von Mueller (42), p. 3. Lefroy (59), Miller's (20).

Anatomical Characters. Transverse section :—

Colour. Very dark chocolate or the colour of dried blood with black zones here and there : runs lighter in colour at times. Sap-wood brownish, écru : ⅜ to ¾ inch wide, well defined from the heart.

Pores. Clear in certain lights in dark pieces, clearer in light wood, not prominent on account of the lack of contrast of colour. Size, 1 or 1–2, with considerable variation in each ring in no particular order : irregularly distributed, often running in oblique, straggling lines which occasionally reverse their direction : mostly single, but joining up into compact strings of about 15 pores : numerous, 0–15 per sq. mm. : round or oval : often contain resin or gum. Radial sec., prominent, coarse, open grooves usually filled with dark contents : often reversed in adjoining bands. In tang. sec., usually sinuous.

Rays. Require the lens : size 5 : uniform and equidistant, much less than the width of the large pores apart : avoiding or interrupted by the pores : very much waved : very numerous, 10-12 per mm. ; denser than the ground tissue. In radial sec. scarcely perceptible : appear as fine, black (or lighter) shining flakes under the lens. In tang. sec., extremely fine blackish lines : scarcely visible with lens, less than 0·1 mm. high.

Rings. Bands or zones of few or crowded pores, often in regular rows of oblique straggling lines : often zones of black colour having no relation to the structure : also denser and softer zones of the ground tissue causing contrast in the solid wood : contour waved.

Soft-tissue. Encircling the pores and compacting the oblique lines.

Type specimens authenticated by the Forest Officer to the Government of Western Australia. In the figure the Rays appear much too broad.

No. 99. AUSTRALIAN RED MAHOGANY.
Eucalyptus resinifera. Sm.

AS PLATE VIII. FIG. 65.

Natural Order. Myrtaceæ.

Synonyms. E. hemilampra. F. v. M. E. multiflora. Poir.

Alternative Names. Red Gum : Jimmy Low in Queensland (12). Red Gum : Forest Mahogany in Queensland and N.S. Wales (85). Red Stringy-bark. (Iron-bark by Laslett (60), possibly in error.)

Sources of Supply. Australia, New South Wales, Queensland (the Southern parts).

Physical Characters, etc. Recorded dry-weight, 61-72½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. No smell or taste when dry. Burns moderately well with much crackling : embers glow in still air. Solution with water and alcohol faint brown.

Grain. Coarse and open in radial section, much finer in tangential section, cross-grained, sinuous. Surface scarcely bright, the pores dull.

Bark. " Reddish, fibrous, rough " (5). " Rough, persistent on the trunk, but more or less deciduous on the branches " (85).

Uses, etc. " Piles, fencing, posts, joists : very durable in the ground " (5). " Il resiste au Sea-worm " (92). " Very strong and durable ; used extensively for fencing, beams, rafters and rough carpentry. In building St. John's Church at Parramatta in 1798, rafters of this timber were used, which were found to be quite sound when the church was pulled down in 1852 " (85). It is well spoken of as a paving wood in Sydney.

Authorities. Nilsson (85), p. 70. F. M. Bailey (5), p. 75. J. F Bailey (6), p. 398. A. Petsche (92), p. 123. Laslett's remarks [see (4) p, 241] do not apply to this species.

Easily confused with Jarrah and many other Red Eucalypti

Colour. Dark red, like dried blood at times. Sap-wood brown, not sharply defined from the heart.

Anatomical Characters. Similar to E. marginata, No. 98. Transverse section :—

Pores. Very prominent, coarse, size 1, little variation : mostly single, but joining up in the strings to as many as 24 or more : few, 9–13 per sq. mm. : roundish : often ruby contents.

Rays. Fairly straight : rather numerous, 9–13 per mm.

Rings. Bands with more or less crowded pores, sometimes in regular rows of oblique straggling strings : also zones of denser and laxer tissue contrasted with each other : no definite boundary.

Soft-tissue. Sparing : encircling the pores and occasionally joining 2 or more pores : also a few fine lines in the denser zones of wood.

Pith. ?

Type specimens authenticated by F. M. Bailey and also by the Sydney Technological Museum.

No. 100. KARRI. Eucalyptus versicolor. F. von Mueller.

PLATE VIII. FIG. 66.

Natural Order. Myrtaceæ.

Synonym. Eu. collosea. F. v. M.

Alternative Names. Kari. White Gum.

Sources of Supply. Western Australia between Cape Hamelin and Albany. Very local.

Physical Characters, etc. Dry weight, 53 to 63 lbs. per cu. ft. Hardness Grade 2, about equal to Boxwood. No smell or taste. Burns well with much crackling, embers glow in still air and consume away to the ash. Solution with water colourless, with alcohol faint brown. Imported usually in deals, etc., for wood paving, but is obtainable to "12 feet wide" (42).

Grain. Undulating, apparently reversed in adjoining belts, but not interlaced : coarse and open in radial sec., much closer in tang. sec. Surface bright and even lustrous or satiny : the pores shine dully, the ground-tissue bright and lighter : the rays dull.

Bark. Deciduous, yellowish white or brown, soft, fibrous, smooth, $\frac{3}{16}$–$\frac{1}{4}$ inch thick, "renewed each year" (21).

Uses, etc. Street paving. "It cracks more than the Jarrah,

but is better for paving" (28). "Durable under exposure, but less so than Jarrah: when used for paving does not become so slippery for the horses' feet" (21). Rafters, bridges, floors, shafts, spokes, felloes and rails. Elastic, tough; does not finish well. Usually confused with Jarrah and other red Eucalypti.

Authorities. J. Ednie Brown (21), p. 12. Petsch (28), p. 129. Millar's (20), p. 1, *et seq.* Lefroy (59).

Colour. Very dark red, flesh red or like dried blood. Sapwood sharply defined from the heart-wood, whitish-brown, ¾–1 inch wide.

Anatomical Characters. As E. marginata (No. 98), with the following trifling differences. Transverse section:—

Pores. Conspicuous: some variation in no particular order: few, 4–10 per sq. mm.: oval: appear pinkish in the solid wood.

Rays. Require the lens: size 5–6: very numerous, 15–19 per mm.

Rings. Clear where a dense zone adjoins a regular pore-zone, but no definite boundary line: bands of a few or crowded pores. See above.

Ground-tissue. Coarse and dense by turns.

Soft-tissue. Encircling, or rather, in patches around, the pores.

Pith. ?

Radial Section. Much lighter in colour than above sec., pores conspicuous, coarse, dark brown, often in numbers side by side with occasional drops of red gum; rays require lens, minute lines or flakes of similar colour to the ground tissue: ring boundaries imperceptible: soft-tissue in light streaks giving the wood *the appearance of animal muscle.*

Tangential Section. The pores very much less conspicuous than in radial section.

Type specimens authenticated by the Forest Officer to the Government of Western Australia.

No. 101. RED GUM (of South-western Australia). Eucalyptus calophylla. R. Br.

PLATE VIII. FIG. 65.

Natural Order. Myrtaceæ.

Alternative Names. Mahogany in Western Australia (12). Fraaiblad Gom-boom in S. Africa (45).

Sources of Supply. Western Australia. Introduced into South Africa and elsewhere.

Physical Characters, etc. Recorded dry-weight, 60–61 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or taste none. Burns very well, rather noisily, easily maintains

a flame, embers glow in still air and consume away to white ash. No doubt good fuel. Solution with water or alcohol yellow.

Grain. Moderately fine, sinuous at times. Surface bright, somewhat lustrous when cleft (not when planed); rays dull. Ground bright. Pores dull except when containing resin-drops.

Bark. "Hard, tough, irregularly fissured, rugged" (17). Brown to brick-red within, crumbling, full of longitudinal, whitish, spindle-shaped, separable threads: ½–1 inch thick.

Uses, etc. "Spokes, shafts, handles: not durable underground" (80). "Sometimes attacked by white ants, otherwise very durable—splits freely—splendid firewood" (17). "Suitable for engineering and architectural works" (61).

Authorities. F. von Mueller (80), p. 4. Ednie-Brown (17). Laslett (61), p. 431. Hutchins (45).

Colour. Brownish-grey.

Anatomical Characters. Similar to those of Eu. marginata, No. 98. Transverse section:—

Pores. Just visible, very plain with lens on account of their brown colour, size 1–2, considerable variation: rather regularly distributed, only joining up to oblique lines in broad rings, otherwise in isolated groups of about 5 pores: scattered: many single, mostly pairs, also nested and radial groups, but when joined forming longer strings: groups separated each by a ray: much brown resin: darker than the ground. The frequency of radial, subdivided groups is a feature. Few 0–3 per sq. mm.

Rays. Need lens, size 5–6, uniform: equidistant: much less than a pore-width apart, widely avoiding the pores, though fairly straight between: weak, thin, white threads: numerous, 9–13 per mm.: about as dense as the ground.

Rings. Fairly clear if indicated by the white, visible, limp, irregular zones of soft-tissue: contour regularly undulating.

Soft-tissue. Fairly visible or at least the most visible feature: limp, white, boundary-like lines irregular in thickness: also short arcs and part circles in the Autumn? wood near the boundary: cells rather large in radial rows of irregular length: also often encircling the pores and winged (reduced) arcs, almost disappearing on the inner side of the ring.

Pith.? Gum-galls present in concentric arcs often to an injurious extent.

Radial Section. Pores fairly prominent, often undulating and out of parallel (cross-grained): appear brown from the resin-drops within them. Rays minute, inconspicuous, colourless, white, dull lines or flakes. Rings doubtful. The gum-galls appear crimson under the miscroscope, and are surrounded by degenerated tissue.

Tangential Section. As the Radial, but the rays appear as very

lax, minute, white lines about 0·5 mm. high, of large cells in a single row.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 102. YORK GUM. Eucalyptus loxophleba. Benth.

PLATE VIII. FIG. 67.

Natural Order. Myrtaceæ.

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight, 64–68 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell slightly vinegary, if any. Taste, none. Burns very well, with a noisy, crackling flame, which is easily maintained: no smell: embers glow in still air and consume away to white ash. Solution with water dirty-yellow: with alcohol similar but fainter.

Grain. Fine, close, sinuous, mottled. Surface bright with dull rays and pores.

Bark. " Persistent, rough " (80). " Dark coloured, rugged " (17). Brown with shallow fissures, of a fibrous nature, though compact, ¼–⅜ in. thick, moderately adherent.

Uses, etc. " The very best in Australia for naves and felloes on account of its toughness. Not fissile enough to spilt into rails, and hence is sought after for this reason for general purposes " (80). " The best in the Colony for naves, felloes and wheelwright's work—felloes in use for over forty years " (17). " Tough, strong — suitable for engineering and architectural purposes " (61). Very hard to saw, planes indifferently, as the grain picks-up in the wood near the centre.

Authorities. F. von Mueller (80), p. 7. Laslett (60), p. 25. J. Ednie-Brown (17), p. 23.

Easily confused with, and difficult to distinguish from all other greyish Eucalypti.

Colour. Greyish-brown: reddish-brown: " reddish " (17). Sap-wood ½–1 inch wide, brownish-white: sharply defined from, and much lighter in shade than the heart-wood.

Anatomical Characters. Transverse section :—

Pores. Need lens, lack both size and contrast, size 4, rather variable, sometimes one ring all large and another all small; fairly evenly distributed in an oblique arrangement, but loose and only discernible in some few rings: usually isolated or few together: subdivided groups extremely rare: oblique strings of from 6–7 separated by rays: few, 30–60 per sq. mm.: a little light-coloured resin: appear as mere perforations.

Rays. Need lens, size 5–6, uniform: equidistant, much less

than a pore-width apart : widely avoiding the pores, rarely a straight interval, very weak, white, thin threads ; many, 16–20 per mm. : denser than the ground-tissues.

Rings. Fairly clear : boundary a narrow zone of wood, poor in pores : contour regular, with long undulations.

Soft-tissue. Difficult to find, very narrow white borders encircling the pores, visible in the solid only.

Radial Section. Pores mere striations, minute, shining lines with brown drops here and there. Rays extremely inconspicuous, dull, white lines, visible in certain lights only. Rings doubtful, a gently shaded, banded appearance.

Tangential Section. As the Radial, but the rays are minute, colourless lines about 0·2 mm. high : they appear to contain drops of resin at times.

Type specimen authenticated by Walter Gill, Forest Officer for Western Australia.

This species is one of the small-pored Eucalypti. It much resembles Gimlet-wood (E. salubris) in structure.

No. 103. GIMLET-WOOD. Eucalyptus salubris. F. v. M.

PLATE VIII. FIG. 68.

Natural Order. Myrtaceæ.

Alternative Names. Fluted Eucalypt (80). Gimlet Gum (67).

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight, 65–68 lbs. per cu. ft. Hardness Grade 5, compare English Ash. Smell and taste none. Burns fairly well, with a short, lively, crackling flame, little smell : embers glow in still air and consume away to the snow-white ash. Solution with water brown.

Grain. Very fine and compact, though open : interlaced. Surface dull in all parts.

Bark. " Smooth, shining, and of a brownish tinge " (80). Thin, smooth, closely adherent, scarcely wrinkled, of a leather-like appearance : dark-brown : pores distinctly visible in transverse section. The trunk of the tree is fluted. My specimen is three-lobed in section.

Uses, etc. " Poles, shafts, rails—although tough, is worked with comparative ease ; the best wood for engraving purposes known from Western Australia " (80). " Cabinet-work and general purposes " (17). Splits badly, planes very smoothly, and is hard to cut with a knife. A good solid wood. Not ornamental.

Colour. Dark neutral-brown, with warmer coloured bands. Sap-wood brownish-white, about ½ inch wide, sharply defined from the heart-wood.

Anatomical Characters. Transverse section :—

Pores. Need lens, small, inconspicuous, size 4, little variation : rather regularly distributed in bands : oblique strings are only visible in well-grown rings, the pores are otherwise too crowded : usually single, but frequent subdivided pairs : each group of pores separated from others by a ray : many, 70–120 per sq. mm. : appear lighter than the ground : many with white contents.

Rays. Difficult to see with the lens, size 5–6, uniform : equidistant : less than a pore-width apart : avoiding the pores more or *less* : light-coloured threads : rarely straight at any point : many, 12–16 per mm. : scarcely denser than the ground-tissue.

Rings. Fairly clear : colour-bands very clear to the naked eye : boundary a line of contrast and often a zone poor in pores : contour in long waves approaching and receding from each other, causing *the rings to become alternately broad and narrow.*

Soft-tissue. Inconspicuous, very narrow borders encircling the pores, sometimes joining them up to oblique strings.

Pith. ?

Radial Section. The pores are fine, scarcely visible lines, partially filled with brown resin or some with a white deposit which is visible to the naked eye, especially where they cross the denser zones. Rays inconspicuous, minute, dull, white lines, visible in certain lights only.

Tangential Section. As the Radial, but the rays are practically imperceptible with microscope (2 inch objective). The rings are readily traceable, almost prominent.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

This is one of the small-pored Eucalypti, and is allied to the York Gum (E. loxophleba) in point of structure.

No. 104. TUART. Eucalyptus gomocephala. D.C.

AS FIG. 69. PLATE VIII.

Natural Order. Myrtaceæ.

Alternative Names. White Gum (60). Tewart, Tooart, etc.

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight, 72–75 lbs. per cu. ft. Hardness Grade 4, compare Maple. Smell and taste none. Burns well with a short, lively, crackling flame and a slight tarry smell ; embers glow in still air : ash, grey. Solution with water, dirty yellow.

Grain. Sinuous, cross-grained, rather fine and open. Surface oily-looking, the ground-tissue greasy when cut with a knife : pores dull.

Bark. "Persistent, wrinkled" (80). "Greyish-white, smoothly wrinkled" (17). Fibrous, not corky, about ¼ inch thick.

Uses, etc. "Strong, durable, does not split in seasoning: invaluable for engineering, cabinet-making, turnery and architectural work; shafts, naves, felloes and various implements, shipbuilding, and general purposes" (80). "The strongest and toughest wood in Western Australia" (17). "Tough and rigid —difficult to cleave. Sound, with few or no defects, most valuable in large scantlings where great strength is needed, shrinks little in seasoning and does not split, not in the least affected by weather, stands high temperatures (i.e., that of the engine room)" (60). See Laslett for mechanical tests. Pares easily with the knife, planes badly, saws with great ease. Not ornamental.

Authorities. F. v. Mueller (80), p. 9. Ednie-Brown (17), p. 15. Laslett (60), p. 432.

Easily confused with other Eucalypti of the same colour.

Colour. "Yellowish-white" (17). Yellowish or straw-colour; light brown. Sap-wood sharply defined from the heart, dull brown.

Anatomical Characters. Similar to E. globulus, No. 106. Transverse section:—

Pores. Readily visible from their lighter colour and masses, size 2, considerable variation from one year to another, but not of necessity increasing in size as the tree ages: usually joined to others but frequent single, isolated pores: often subdivided: few, 6–20 per sq. mm.: sometimes as many as 15 in a string.

Rays. Clearly visible with lens, always traceable: rarely quite straight: very weak, thin, light-coloured threads: many 10–14 per mm.

Rings. Clear. The boundary varies: sometimes a zone poor in pores or a fine white line about the width of a ray, both accompanied by a change in the direction of the pore-strings.

Soft-tissue. Readily visible, as rather wide borders encircling the pores, and perhaps also the fine white boundary-like line.

Pith. ?

Radial Section. Pores readily visible but scarcely prominent, usually reversed in adjoining belts, undulating: contain gummy-looking drops. Rays very inconspicuous, colourless, visible in certain lights only. Rings indicated by the reversed pores and fibres.

Tangential Section. As the Radial, but the rays only just visible with the lens as white, coarse-celled lines about 0·1 mm. high.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 105. AUSTRALIAN BOX. Eucalyptus hemiphloia. F. v. M.

AS FIG. 69. PLATE VIII.

Natural Order. Myrtaceæ.

Physical Characters, etc. Recorded dry-weight, 70 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell and taste, little if any when dry. Burns well with a lively flame, little smoke or smell : heat expels resin. Solution with water faint brown.

Grain. Very fine, though open. Surface bright, smooth, feels like Boxwood : when exposed it weathers a silvery-grey.

Bark. " Silvery-grey, persistent, wrinkled and full of clefts upon the butt of the tree, deciduous in long strips upon the branches " (85).

Uses, etc. " Timber of first-rate quality, obtainable in large scantlings—tough, durable, but liable to suffer from dry-rot and the attacks of the white ant ; does not stand long in the ground : excellent fuel " (85). " Famous for hardness, toughness and durability " (C. Morris). " Excellent, tough, durable, of great lateral strength ; sleepers, naves, felloes, jetty and bridge piles, mining slabs, fence-posts, cogs, tree-nails, large screws, mauls and handles " (67). " Very tough and elastic " (5). " Many varieties. Non-fissile : of great durability when exposed : recommended for bridge-work " (27). A tree attaining a height of 180 ft. by 6 ft. in diameter.

Authorities. F. M. Bailey (5), p. 72. Maiden (67). De Coque (27), p. 206. Nilson (85).

Colour. " White " (85). " Yellowish-grey " (5). Khaki, with white pores, uniform.

Anatomical Characters. As Tuart (No. 104), with variations as follows. Transverse section :—

Pores. Clear, sometimes prominent in the solid from their colour : size 2, little variation.

Rings. Very doubtful : an occasional incomplete pore-ring of one or two rows, but chiefly indicated by a change in the disposition and number of the pores : contour irregular : *seldom a pore-less zone.*

Soft-tissue. In narrow borders encircling the pores.

Radial Section. Pores readily visible, lighter in colour than the ground.

Type specimens authenticated by F. M. Bailey and by Frank C. Stone.

This wood is easily confused with many other Eucalypti of the same colour, especially E. gomocephala, which should be referred to (*see* No. 104.).

No. 106. BLACKBUTT. Eucalyptus pilularis. Sm.

AS FIG. 69. PLATE VIII.

Natural Order. Myrtaceæ.

Synonyms. E. semicorticata F. v. M. E. incrassata Sieb. E. ornata Sieb. E. persiciflora D.C. The E. pilularis D.C. is E. viminalis. Labill., and not the present species.

Alternative Names. Tcheergun. Toi in Queensland (5). Mahogany (60). Flintwood (85). White-top: Benaroon: Willow: Mountain Ash (12).

Sources of Supply. New South Wales, Queensland and Victoria.

Physical Characters, etc. Recorded dry-weight 46 to 59¼ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell none. Taste astringent. Burns well, with a lively crackling flame: embers do not glow in still air, but leave the carbonized wood. Said to be inflammable. Solution brown.

Grain. Coarse and open, but very dense. Surface dull.

Bark. " Persistent at the base of the tree, but falling off in strips from the upper part of the trunk and branches " (5). " Sub-fibrous " (67).

Uses, etc. " House-building and fencing in Queensland. Tough, durable and strong " (5). " Flooring-boards, telegraph-poles and sleepers " (52). " Particularly recommended for paving " (92). " First-class timber for general building purposes, liable to crack and open, subject to pin-holes " (27). " Size, 50–150 high by 2–4 ft. diameter " (15). " Often confused with Tallow-wood " (27). " Excellent for strength and durability: bridge-planking, decking, piles, paving-blocks: warps and twists when exposed to the sun " (67). Hard to saw: pieces rip out during planing.

Authorities. F. M. Bailey (5), p. 70. Kew Guide, (57), No. 3, pp. 49, 51 and 68. Boulger (15), p. 169. Laslett (60), p. 251. Russell (52), p. 7, with mechanical tests. Petsche (92), p. 123. Maiden (67). De Coque (27).

Colour. Rosy yellow (92). Light grey (52). Khaki or uniform greyish-brown, with lighter sap-wood.

Anatomical Characters. As those of Tuart, No. 104 (which see), with the following trifling differences:—

Transverse Section. Conspicuous, little variation in size. Rings very doubtful, chiefly indicated by the change in the arrangement or number of the pores: no definite boundary: contour regular. " Often gum-veins in circles " (27).

Radial Section. A shade lighter than the transverse, pores prominent, open, clearly-cut lines, darker in colour than the ground-tissue, and often running obliquely to each other.

Type specimens authenticated by F. M. Bailey and R. T. Baker.

No. 107. BLUE GUM. (of Tasmania) Eucalyptus Globulus. Lab.

PLATE VIII. FIG. 69.

Natural Order. Myrtaceæ.

Synonym. E. globulosus. St. Laz.

Alternative Names. Grey Gum: Bastard Box in N.S.W. Kurpoora maram in Madras (37). The Blue Gum of Queensland and N.S.W. mentioned by Bailey is E. tereticornis. Sm., and that of Western Australia cited by J. Ednie-Brown is E. megacarpa.

Sources of Supply. Australia in Victoria, rare in N. S. Wales: South Tasmania. Introduced into Europe, N. Africa, N. America, India and S. Africa.

Physical Characters, etc. Recorded dry-weight, 43-54 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell during working like acetic acid. Taste astringent. Burns well, embers glow in still air. Solution with water pale brown.

Grain. Moderately fine and open. Surface bright, the pores dull.

Bark. "Fibrous, deciduous" (37).

Uses, etc. "Beams, railway-sleepers, piers, bridges, keels, keelsons, fences. Very durable. Liable to warp and often unsound in the heart" (60). "Difficult to work, tenacious: . . . the least valuable of the Eucalypti" (69). "Strong and durable: . . . equal to English Oak in transverse strength" (85). Splits readily and cleanly. I have met with hidden cavities in this wood where the fibres have been torn asunder by the shrinkage while drying.

Authorities. Gamble (37), p. 188. Nördlinger (86), vol. vi. p. 18. Laslett (60), p. 243. Holtzapffel (48), p. 86 (as E. piperita ?). Newbery (83). Mathieu (69), p. 189. Nilson (85), p. 63.

Colour. Pale straw: pinkish: brownish. Sap-wood reddish-white.

Anatomical Characters. Transverse section:—

Pores. Readily visible, size 3, medium, variable, and increasing in size as the tree ages: in loose, oblique, straggling lines leaning to the right in some rings and to the left in others: few, 5–24 per sq. mm. In narrow rings too crowded to show the true arrangement, and more numerous, 8–40 per sq. mm. Rarely two in contact, almost invariably single: appear white in the solid.

Rays. Difficult to see with lens, size 5-6, uniform: equidistant, less than the width of a pore apart, avoiding or running closely round the pores: numerous, about 17 per mm.: rarely tapering: less dense than the ground-tissue.

Rings. Doubtful : the change in the disposition of the pores may indicate the limit of the year's growth : fast grown and wide.

Soft-tissue. Very narrowly encircling the pores. It is interesting to note that it shows up best in the transparent section when polarised with a dark background and the prisms crossed.

Pith. ?

Radial Section. The pores are prominent, colourless lines. The rays are small colourless flakes, just visible. The rings are doubtful, but the reversed direction of the pores is usually apparent, and gives the wood a waved or cross-grained appearance.

Tangential Section. The pores appear less numerous and the rays are imperceptible with lens, being about 0·5 mm. high. Soft tissue usually visible.

Type specimens authenticated by R. T. Baker and R. B. Hough, and also from logs sent to the Colonial and Indian Exhibition from South Africa.

No. 108. BLACKBUTT. Eucalyptus patens. Benth.

As Fig. 69. Plate VIII.

Natural Order. Myrtaceæ.

Alternative Names. The Blackbutts of N.S. Wales are E. obtusifolia and E. pilularis (85).

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight, 74 lbs. per cu. ft. Hardness Grade 4, compare Oak. Smell none or slightly vinegary. Taste none. Burns with a lively, crackling flame, very inflammable, but the embers do not glow in still air, but leave a carbonized stick. Solution with water, very thin brown.

Grain. Moderately fine and open. Surface dull : rays rather crystalline under lens.

Bark. $\frac{1}{2}$ inch thick (about) : of two layers, the inner $\frac{4}{5}$ of the thickness, finely fibrous, compact, khaki-coloured : the outer thin, smooth, coarsely fibrous, inclined to crumble, separable.

Uses, etc. "Tough, durable—wheels, shafts and farming implements : appears to last well underground, difficult to split or burn" (17).

Authorities. J. Ednie-Brown (17), p. 26.

Easily mistaken for many other greyish or brownish Eucalpyti.

Colour. Greyish-brown : khaki. Sapwood brownish-white, 1 inch or so wide, well defined from the heart-wood.

Anatomical Characters. Similar to E. globulus, No 107. Transverse section :—

Pores. Conspicuous, size 1–2, little variation : irregularly distributed in oblique, straggling lines, *often interrupted*,

continuous only in wide rings : sometimes reversed in direction, sometimes crossing or branched : mostly single or pairs : few, 2-25 per sq. mm. : filled : appear much lighter in the solid wood.

Rays. Need lens : many, 13-16 per mm.

Rings. Very clear : boundary and zone poor in pores and a strong definite contrast between neighbouring zones : contour regular.

Soft-tissue. Prominent in very narrow borders encircling the pores : conspicuous from their lighter colour : cells in radial rows forming patches rather than circles.

Radial Section. Pores rather prominent, scarcely clearly-cut lines : sinuous : rather darker than the ground. Rays just visible in certain lights ; white or hoary. Rings doubtful, but there are occasional denser zones with few pores.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 109. SALMON GUM. Eucalyptus salmonophloia. F. v. M.

As Fig. 65. Plate VIII.

Natural Order. Myrtaceæ.

Alternative Names. Salmon-barked Eucalypt. Salmon-barked Jarrah (80).

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight, 79 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or taste none. Burns very well, with a lively, crackling flame, easily maintained : no smell, embers glow in still air, ash white. Solution with water the colour of the wood, afterwards with alcohol scarcely perceptible.

Grain. Very fine and smooth, though open. Surface rather dull. Rays rich, obscure, but shining : pores with resinous lustre : feels like Boxwood.

Bark. "Grey : slightly purplish : oily lustre" (80). Brown, with a silvery lustre like micaceous sandstone, finely wrinkled otherwise quite smooth : ¼-½ inch thick : one layer only : encloses large, white, spindle-shaped fibres.

Uses, etc. "Exceedingly tough and hard, believed to be superior to any of the Western Australian timbers" (80). "Durable : mining, wheelwright's work, piles" (17). Can scarcely be split. Saws almost as easily as English Beech : planes badly, as the grain "picks-up" in belts : very tough : a good solid wood : the most beautiful of all the Eucalypti in point of colour.

Authorities. F. v. Mueller (80), p. 13. J. Ednie-Brown (17), p. 27.

Practically indistinguishable from the Morrel Gum (E. longicornis), No. 110, except by means of the bark. Also much like all the red Eucalypti.

Colour. Deep, rich red : blush-red : carmine : salmon-colour : sap-wood pinkish white, ¼ to 1 inch wide, well defined (not sharply) from the heart-wood.

Anatomical Characters. Transverse section :—

Pores. Need lens, though the pore-groups are occasionally visible, size 3, little variation, and that irregular : rather evenly distributed, often forming oblique lines without actually touching each other : rarely subdivided groups or pairs, practically all single : few, 10-35 per sq. mm. : filled with beautiful carmine resin, of which more than one globule is visible in each pore.

Rays. Need lens, size 5-6 (nearer 6), uniform : equidistant, much less than a pore-width apart, widely avoiding the pores, rarely straight, crooked at the ring-boundaries : very weak, thin, lighter-coloured threads : many, 16 to 22 per mm.

Rings. Faintly indicated : boundary, a zone poor in pores : contour regular or very gently undulating.

Soft-tissue. Difficult to see, merely narrow borders encircling the pores : lighter in colour, easily overlooked.

Radial Section. Pores very fine, open grooves containing brilliant, carmine resin : extremely tortuous, sinuous and reversed (cross-grained), interlaced to a greater degree than most Eucalypti. Rays extremely minute, inconspicuous white lines. Rings visible by the conspicuous change of direction in the pores, and also the occasional smooth bands.

Tangential Section. As the radial, except the rays, which need the microscope, about 0.1 mm. high. When moistened they appear as large-celled, spindle-shaped lines, of 6 to 7 cells mostly containing resin.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 110. MORRELL. Eucalyptus longicornis. F. v. M.

As Fig. 65. Plate VIII.

Alternative Names. Morrell Gum (17). The same popular name is applied to E. microcarpa.

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight, 66 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell faintly vinegary or none. Taste none. Burns badly, with a

short, noisy flame : embers glow in still air : pure white ash : no smell. Solution with cold water red : none when treated afterwards with alcohol. Potash gives a vinous-brown reaction, and sulphuric acid a dark ppt. in a crimson solution.

Grain. Fine and open. Surface dull.

Bark. Rough, irregularly fissured, dark brown : one layer, the outer scales marked off by a light-coloured layer enclosing spindle-shaped strands of hard tissue : ¼ to ½ inch thick.

Uses, etc. "Remarkably hard : rafters, shafts, naves, spokes, wheelwright's work : straight and lasting : rails up to 25 feet long can be obtained" (80). "Very strong in every way, especially laterally : handles, mallets, etc. : durable" (17). *Splits readily*, saws easily and sweetly, planes easily, but pieces rip out : brittle.

Authorities. F. von Mueller (80), p. 12. Brown (17), p. 25. Kew Guide (57), p. 70.

Colour. Rich red, carmine, like Salmon Gum. Sap-wood whitish, 1 to 1½ inches wide, well but not very sharply defined from the heart-wood.

Anatomical Characters. Identical with those of Salmon Gum (No. 109), from which it is extremely difficult to distinguish when the bark is not present. The greater fissibility, the tortuousness of the grain in tangential section, and the greater number of pores to the sq. mm. (16–35) may provide useful guides. The rings are visible by the slight reversal in the direction of the pores, and the soft-tissue is scarcely traceable.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 111. RATA. Metrosideros robusta. A. Cunn.

PLATE VIII. FIG. 70.

Natural Order. Myrtaceæ.

Sources of Supply. New Zealand, in the North Island only.

Alternative Name. Northern Rata.

Physical Characters, etc. Recorded dry-weight, 61¼ lbs. per cu. ft. Hardness Grade 4, compare Maple. No taste or smell. Solution, faint brownish, deepens upon the addition of potash ; the chips if afterwards treated with alcohol yield no further colour. Burns well with a noisy, spurting flame ; heat expels a gum ; embers glow brightly in still air ; no aroma. "Ignites readily" (24).

Grain. Fine though open ; compact and dense.

Bark. Red, ⅛–¼ inch thick, of two layers, the inner fibrous and laminated, the outer covered with thin, brittle scales like those of pine ; not very closely adherent. "Dark brown and rugged in appearance" (60).

Uses, etc. Saws and planes up sweetly and smoothly though hard. "A large tree" (61). "Timber 12–30 inches square, by 20–30 ft. long, not difficult to work . . . fit for shipbuilding and any work in civil architecture requiring timber of straight growth and large dimensions . . . said to be durable" (60). "Suitable for piles, bridge and engineering work" (61). "Very dense and durable . . . railway-waggons, shipbuilding" (57). "Strong, tough crooked . . . difficult to get a plank out of it . . . resists wet" (24).

Authorities. Laslett (60), p. 309. Ditto (61), p. 434. Kew Guide (57), p. 76. Collinson (24).

Colour. Heart-wood, brownish-red, very uniform. Sap-wood, slightly lighter and browner than the heart-wood and generally merging into it. "Red" (61).

Anatomical Characters. Transverse section:—

Pores. Large, prominent and readily visible on account of their size and colour, size 3, considerable regular variation but never very small: in loose oblique lines: no poreless zones: evenly distributed: rarely if ever subdivided or in contact with each other: few, 3 to 12 per mm.: occasionally with red or white contents.

Rays. Need lens, size 5–6, uniform: equidistant, less than a pore-width apart but rarely avoiding the pores: many, 10–15 per mm.: red.

Rings. Obscure, not traceable in the solid wood.

Soft-tissue. Rare, in extremely narrow circles round the pores.

Pith. ?

Radial Section. Much lighter in colour than the transverse. Pores, obscure, fine, slightly darker or hoary scratches: not *sinuous.* Rays just discernible, narrow lines with very little contrast of colour. Rings not traceable. Soft-tissue, fine, hoary borders to the pores.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 112. RATA. Metrosideros lucida. A. Rich.

PLATE VIII. FIG. 70.

Natural Order. Myrtaceæ.

Source of Supply. New Zealand only.

Alternative Names. Ironwood: Southern Rata (91).

Physical Characters, etc. Recorded dry-weight 63–71½ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or taste none. Solution pinkish turning deep brownish purple with potash: no ppt. Burns well with a long, crackling, smoky flame and tarry smell: heat expels drops of yellow gum: embers glow in still air.

Bark. Whitish externally, red or brown beneath with a purplish cast : ⅛-¼ inch thick, compact, fibrous : scaling in papery flakes.

Uses, etc. Very hard to work. " One of the strongest woods in existence, . . . logs may be had 20–50 ft. long by 1–4 ft. in diam. . . . its durability is astounding, . . . shipbuilding, sleepers, railway-carriage building, bridges, wharves and all purposes where great strength is required, . . . spokes, hubs, felloes and wheelwright's work " (91).

Authorities. Perceval (91), pp. 11, 14, 44. Smith (111), p. 347.

Colour. " Red, varying greatly in depth of tint " (91). No distinction between sap-wood and heart-wood or they gradually merge one into the other.

Anatomical Characters. Transverse section.

Pores. Very readily perceptible, occasionally prominent on account of their white contents : size 3–4, little variation if any : few 10–25 per sq. mm. : thinly scattered, but rather more numerous in certain zones (? Spring wood) : a tendency to very loose oblique lines, mostly single and seldom in contact with each other : frequently with chalk-like contents.

Rays. Need lens, size 5–6, uniform : equidistant, a pore-width apart, scarcely avoiding the pores : weak but straight : slightly lighter than the ground-tissue : many 10–14 per mm.

Rings. Extremely vague, perhaps indicated by an occasional pore-less zone.

Soft-tissue. Rare : an extremely fine border encircling the pores, scarcely perceptible. Lines connecting the pores (if any) imperceptible with lens.

Pith. ?

Radial Section. Pores readily visible, rather fine scratches, often with white contents : rays just perceptible fine brown lines on a planed surface : rings and soft-tissue not perceptible.

Tangential Section. As the Radial, but the rays are scarcely visible fine lines but with the microscope they look like chains of fine brown dots : an unusual appearance. Rings traceable as vague fringes and loops of pore-less wood.

Type specimens authenticated by the Forest Officer to the Government of New Zealand.

No. 113. POHUTIKAWA. Metrosideros tomentosa. A. Rich.

PLATE VIII. FIG. 70.

Natural Order. Myrtaceæ.

Source of Supply. New Zealand only.

Physical Characters, etc. Recorded dry-weight 53½–65 lbs.

per cu. ft. Hardness Grade 4, compare Maple. Taste or smell none. Burns well with a long, smoky flame and a slightly tarry smell; a brown juice is expelled by heat: embers glow in still air. Solution pinkish, turning brown upon the addition of potash with a copious reddish-brown ppt.

Grain. Rather fine. Surface scarcely bright.

Bark. "Ragged in appearance, thick, reddish-grey in colour" (60). Grey above, brown internally, fibrous, dry, about ⅛ inch thick, separating in small scales.

Uses, etc. "Strong, admirably adapted for the frames of ships. Timber 10–20 ft. long by 9–16 inches square" (60). "Like Rosewood . . . difficult to work as it breaks the edges of tools" (111).

Authorities. Laslett (60), p. 309. Smith (111), p. 331.

Colour. Uniform, red heart-wood ill-defined from the 1–1½ inches of lighter sap-wood.

Anatomical Characters. As those of Metrosideros lucida (No. 112), with the following differences:—

Pores. Regularly diminishing a little from the inner to the outer side of the ring and rarely if ever having white contents: size 3: 5–12 per sq. mm.

Rays. Size 5–6 and from 14–18 per mm.

Rings. A little more definite and considerably clearer in tangential section in alternate light and dark loops.

Type specimens authenticated by the Forest Officer to the Government of New Zealand.

No. 114. PAPER-BARK TREE. Melaleuca leucadendron. Linn.

PLATE VIII. FIG. 71.

Natural Order. Myrtaceæ.

Alternative Names. White Tea-tree (66). Paper-barked Tea-tree (12). Bethar at the Mitchell River: Atchoourgo at Port Curtis (5). Milk-wood tree (61). Swamp Tea-tree in New South Wales (85).

Physical Characters, etc. Recorded dry-weight 47–54¾ lbs. per cu. ft. Hardness Grade 6, compare Beech. Taste insipid. Smell when worked like Brazil nuts. Burns well with a short, lively flame: heat expels resin: embers glow in the still air: sometimes an unpleasant smell: ash, grey. Solution with water, yellow: afterwards with alcohol, dirty white.

Grain. "Close" (5). Fine to medium, open: sometimes very sinuous, at others straight. Surface uniformly dull.

Bark. White, easily detached, consisting of many layers of filmy tissue like thin, transparent tissue-paper (1 cell only in

thickness) held together by pink strips of bast: the inner surface next the log resembles chamois leather: ½–1 inch thick.

Uses, etc. "Resists white ants, . . . shipbuilding, houses, . . . generally useful" (80). "Extremely durable in the ground" (61). "Valuable for underground work and wharf-piles" (5). "Durable, cross-grained, . . . lasts well underground, resists white ants: posts, fencing" (17). "Recommended for millwright's work, carpentry, turnery and possibly wood-engraving" (61). "Excellent for fencing-posts in damp situations, being almost imperishable underground" (85). Warps badly during drying. A remarkably variable wood. My specimen from Western Australia weighs only 38½ lbs. per cu. ft., being partly sap-wood. It had the typical bark and is the one described here. One would hardly suspect its relationship with the other equally well authenticated specimens from Queensland in my collection.

Authorities. F. v. Mueller (80), p. 16. F. M. Bailey (5), p. 67. Ednie-Brown (17), p. 28. Laslett (61), p. 423. Nilson (85), p. 5.

Colour. Pinkish (5). Yellow (61). Red: brownish-red. Sap-wood écru or brownish-white, not defined from the heart-wood but merging into it gradually.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 2–3, not much variation: irregularly distributed occurring in straggling, oblique strings like Eucalyptus but not always joining nor even indicating them: chiefly single, rarely subdivided or grouped: few 20–30 per sq. mm.: little resin: appear as perforations.

Rays. On the limit of vision: size 5–6, uniform: equidistant, a pore-width or less apart, slightly avoiding the pores, fairly straight, firm, brownish threads: many 12–13 per mm.

Rings. Very indistinct, boundary perhaps the zones poor in pores along with a contrast in the size of the pores.

Soft-tissue. Abundant in irregular patches, sometimes uniting to regular, concentric lines but generally forming the bulk of the tissue: also in borders encircling the pores, which are broad in some dark specimens and practically imperceptible in light ones (see note above).

Radial Section. Pores readily visible scratches with hoary borders in dark wood: often a white deposit which fills the pores more completely than the resin does. Rays visible in certain lights. Rings faintly indicated by the contrast of the denser and laxer zones.

Tangential Section. As the Radial, but the rings are more prominent. Rays just visible with lens when moistened (in the solid wood).

Type specimens authenticated by F. M. Bailey and by the Forest Officer to the Government of Western Australia, but the

difference between them is so great, as mentioned above, that I am forced to conclude that the specimen from the former locality is from a very old tree and that the variation of the structure as the tree ages is very much greater than is usual in woods of other kinds. (Compare Fig. 161, Pl. XVIII.). The pith-side of Fig 71 is to the left.

No. 115. A Variety, Melaleuca Leucadendron. Var. Cunninghami.

Received from Mr. F. M. Bailey, Brisbane, weighs 66 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Colour, dark, nut-brown. This shows a further considerable departure from the above type.

No. 116. WATERBOOM. Eugenia cordata. Laws (not D.C.).

PLATE VIII. FIG. 72.

Natural Order. Myrtaceæ.

Source of Supply. South Africa, Natal.

Physical Characters, etc. Recorded dry-weight 60 lbs. per cu. ft. Hardness Grade 5, compare English Elm. Smell or taste none. Burns very well, no aroma, heat expels an unusually copious orange-coloured juice : embers glow in still air. Solution pale, the colour of the wood, gives a copious ppt. upon the addition of potash.

Grain. Very fine, compact, dense and even. Surface dull.

Bark. About $\frac{1}{8}$ inch thick : light yellowish brown, of two layers, the inner woody, the outer separating in small, soft, thin scales : like cork to the touch.

Uses, etc. Unrecorded. An extremely tough and solid wood, which saws with some trouble yet kindly : a good turner's wood, much resembling that of the European Pear tree. It would probably be useful for screws and levers.

Colour. Heart-wood uniform, brown : defined from the sap-wood, which is rather lighter and about 2–3 inches wide.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 5, considerable variation : widely scattered : nearly all single, pairs very rare : few 11–20 per sq. mm.

Rays. Need lens, size 5–6, apparently two sizes, but really thick in the middle, tapering both ends to fine points : "middles" only, 2–4 per mm., or together with "ends," 18–26 per mm : direct, not avoiding the pores : slightly lighter in colour than the ground-tissue.

2–22 pores (usually over 10): groups oddly shaped like bubbles in froth and apparently connected radially at times: oval: some red contents: appear light-coloured.

Rays. Need lens, size 5–6, uniform: somewhat irregularly spaced: running round the larger pore-groups, very irregularly bent and waved, less than a pore-width apart: very many, 12–14 per mm.: lighter than the ground and much denser.

Rings. Obscure. The vague zones here and there where the lines of soft-tissue are more or less crowded may indicate the limits of annual growth.

Soft-tissue. Very plentiful and the great feature. Innumerable, concentric, undulating lines, size 2–3 (ray-scale) and 7–11 per mm., of coarse cells, size 7 (pore-scale): the same colour as the rays and making a fairly regular network with them; contour regularly crenate.

Flecks occur at times of the same colour as the rays and linear in shape.

Pith. ?

Radial Section. Pores not prominent: rays minute crystalline flakes: soft-tissue in many fine, parallel lines, inconspicuous but a feature.

Tangential Section. As the Radial, but the rays are minute lines which exhibit minute drops of red resin when moistened.

Type specimen authenticated by the Forest Officer to the Government of British Guiana. From a log sent to the Colonial and Indian Exhibition.

No. 118. MONKEY-POT. Lecythis grandiflora. Aubl.

PLATE IX. FIG. 73.

Natural Order. Myrtaceæ.

Alternative Names. Wadaduri (78). Cuyas de Macaco (A. R. Wallace, *Travels on the Amazon*, p. 34). Canari-Macaca: Pao Macaco (76). Sapucaia: Marmites de Singe: in Brazil (99).

Sources of Supply. British Guiana, Brazil and Tropical Africa generally

Physical Characters, etc. Recorded dry-weight 74 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell and taste faint if any. Burns well with a lively, noisy flame and a faintly resinous smell: embers glow in still air and leave a considerable amount of ash. Solution practically colourless.

Grain. Extremely even, dense and smooth. Surface lustrous, feels smooth and cold like Ebony but less so than L. Ollaria. No. 117.

Bark. ?

Uses, etc. "Turnery, furniture and barrel-staves" (78). Polishes almost naturally as it leaves the tool. The shavings are sticky when compressed in the hand and retain the form of the palm . . . planes badly. "May be met with in the form of logs up to 28 in. square free of sap-wood. The tree sometimes attains the height of 100 feet." (78).

Authorities. McTurk (78), No. 22. Miers (76). Saldanha da Gama (99).

Colour. Uniform light red or orange-red heart-wood defined: from the lighter sap-wood, which is about 1 inch wide. According to Boulger it is light brown, but he probably confuses it with one of the varieties of L. Ollaria.

Anatomical Characters. Identical with those of L. Ollaria, with the following small differences:—

Transverse Section. Pores conspicuous from their lighter colour: 8–50 per sq. mm. Rays very many, 13–20 per mm. Flecks present with strongly-tapering fringes (false rays).

Radial Section. Pores very inconspicuous and difficult to find, slightly lighter in colour, whitish, filled with Tyloses.

Tangential Section. The rings appear as faint, whitish, angular loops which give the wood a hoary appearance.

Type specimen authenticated by the Forest Officer to the Government of British Guiana.

No. 119. TULIP-WOOD. Physocallyma scaberrimum. Pohl.

PLATE IX. FIG. 74.

Natural Order. Lythrarieæ.

Synonyms. P. floridum, Pohl. P. floribundum ?

Alternative Names. Bahia Tulip-wood. "Sebastiao de Arruda in the Central and North Province, Brazil, also Cego-machado" (49). Brasilianische Rosen-holz: Pao de Rosa: Cego Maschado (131).

Sources of Supply. Peru: Brazil.

Physical Characters, etc. Recorded dry-weight, 48–61¼ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell fragrant when worked. Taste, nauseous, becoming slightly acrid. Burns well and quietly with a peculiar, sickening, unpleasant smell; embers glow in still air: heat expels a red-coloured resin. Solution with water none; afterwards with alcohol, either hot or cold, crimson or magenta.

Grain. Very dense, open but apparently even, the pores being few. Surface rather lustrous, rays dull, ground bright, the pores shining (resinously).

Uses, etc. Turnery. "Cabinet-making . . . a small tree" (49). Fades: very wasteful and splintery.

Authorities. Miers (48). Holtzapffel (29), p. 108. Wiesner (131), L. 12, p. 975.

Colour. Flesh-and-blood colour somewhat resembling that of striped red and white tulips.

Pores. Only just visible though occasionally large: no contrast of colour: size 1–2: the large ones in an interrupted pore-ring of one or two rows at most: subdivided in groups of from two to seven pores radially disposed: 7–10 per mm.: carmine resin in those of the colour-bands: decreasing much in size from the Spring to the Autumn zone; the colour bands quite independent of the structure.

Rays. Need lens, size 5–6, uniform: equidistant, a pore-width or less apart, running closely round the pores: light coloured in the pigmented zones: very numerous, 11–15 per mm.

Rings. Very clear in transparent section, less so in the solid; the boundary a fine line of Autumn wood and also a line of contrast between the pore-less Autumn and the large-pored Spring wood: contour beautifully regular but the colour-zones are irregular and broad.

Soft-tissue. Abundant in extremely fine, numerous, concentric lines, often continuous and often connecting the pores: does not resemble a boundary line but makes a fine reticulation with the rays: size 5–6 or 7 (ray-scale).

Radial Section. Pores rare but readily visible, red, shining lines with occasional drops of carmine resin: rays extremely fine, hoary flakes: difficult to see: rings traceable with difficulty but the colour bands are very striking: soft-tissue readily visible with the lens as fine, hoary striations.

Tangential Section. As the Radial, but the rays are almost imperceptible with a strong lens.

Type specimens from commercial sources. Not authenticated, but they correspond with Miers' description and with other species of the same Natural Order.

No. 120. ASSEGAI-WOOD. Curtisea faginea. Ait.

PLATE IX. FIG. 75.

Natural Order. Cornaceæ.

Synonyms. C. fagifolia. Salisb.

Alternative Names. Hassagay-wood: Zagaiholz: Beech-leaved Assagay-boom. Umnoiso: Umguna (15). Cape Lancewood: Oomlehbe (19)

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight, 60 lbs. per

cu. ft. Hardness Grade 2, compare Boxwood. Smell when sawn something like fresh Pine, otherwise none: taste none. Burns indifferently: embers glow in still air: solution with water pinkish-brown.

Grain. Extremely fine, close and even: surface bright with dull pores which are however too small to affect the appearance.

Bark. Smooth and leathery, ⅛ inch thick.

Uses, etc. "Furniture, tools, waggons . . . tough" (19). Weapons by the natives of South Africa. It might be useful for many purposes, as apart from a slight brittleness it works excellently and will take a good finish. Usually confused with Vlier (Nuxia floribunda) and Red Els (Cunonia capensis).

Authorities. Nördlinger (86), vol. vii. p. 26. Boulger (15), p. 156. Laslett (60), p. 103.

Colour. Dark reddish-brown heart-wood, quite uniform, no shaded zones: gradually fading into the somewhat lighter-coloured sap-wood.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 5, almost uniform: evenly distributed: numerous, about 45–100 per sq. mm.: mostly single, many pairs, rarely if any threes: oval.

Rays. Obscure and difficult to see with lens, medium, size 4, apparently two sizes but really long-drawn-out, the "middles" 2–3 per mm. with many "ends" between them, i.e. 18–20 per mm. and extremely fine, Grade 7, the width of a pore apart, straight, not avoiding them: very little denser than the ground-tissue: dark-brown.

Rings. Vague and not always discernible: the boundary a narrow zone of dense wood: contour well-rounded.

Soft-tissue. Very little: isolated cells and short one-rowed strings here and there.

Pith. ?

Radial Section. The pores are extremely fine lines, difficult to see with the lens: the rays are darker brown flakes forming a pretty, though inconspicuous figure: the rings are not traceable.

Tangential Section. As the Radial, but the rays are minute, brown lines about 1 mm. high, almost imperceptible with the lens.

Type specimens from a log exhibited at the Colonial and Indian Exhibition.

No. 121. CORNEL. Cornus florida. Linn. (not Hook.)

PLATE IX. FIG. 76.

Natural Order. Cornaceæ.
Synonyms. Benthamia florida. Spach.

Alternative Names. Flowering Dogwood, Boxwood in U.S.A. (49). Dogwood, Cornelian-wood in England.

Source of Supply. United States of America.

Physical Characters, etc. Recorded dry-weight, 47–50½ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or taste none. Burns well and quietly: heat expels a crimson juice: embers glow in still air. Solution with water a dirty lilac-colour, strong.

Grain. Fine, close and dense. Surface lustrous: the rays are duller than the ground-tissue.

Bark. "Reddish-brown checked cross-wise as well as longitudinally in four- or several-sided plates, thus presenting a peculiarly checkered appearance" (49). Of one layer showing many hard rod-like bodies and the continuations of the rays: much broken up.

Uses, etc. "Turnery, wood-engraving, cogs, hubs" (49). "Bearings, barrel-hoops" (100). Shuttle-making: formerly for arrow-making and for charcoal for gunpowder. "A small tree about 15 inches in diameter at most" (49).

Authorities. Sargent (100), No. 151. Hough (49), part iv. p. 2 P. Holtzapffel (48), p. 83. Wiesner (131), L. 12, p. 984. Usually confused in point of appearance with Beech, Maple and Virginian Dogwood, and through confusion of names with other species of Cornus and with a score of other Dogwoods, so-called, from all parts of the world.

Colour. Reddish-white: "Chocolate-brown" (49). "Sometimes changing to green and red" (100). My specimens are probably pieces of second-growth wood to which the following description will only apply.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 4–5: little variation: evenly scattered but rather fewer in the Autumn wood: mostly single, some pairs, rarely more together: few, from 15 in the Autumn wood to 90 per sq. mm. in the Spring wood.

Rays. Just visible, size 3, or rather less: moderately broad, apparently of two sizes. The larger 2–4 per mm.: the smaller 8–11: tapering inwards only: denser than the ground-tissue: straight, not avoiding the pores (except the extremely fine ends): brown or reddish.

Rings. Clear but not prominent: boundary a line of contrast between the denser Autumn wood and the more porous Spring wood: contour undulating.

Soft-tissue. Abundant in isolated cells and strings of cells.

Pith. Roundish or lobed, 1–2 mm. thick, hard, white to brown.

Radial Section. Pores very fine, shining lines, need lens. Rays conspicuous, flesh-coloured, narrow flakes forming a pretty figure. Rings just traceable.

Tangential Section. As the Radial, but the rays are just visible as crowded, brown lines about 1 mm. high.

Type specimens from commercial sources. Not authenticated, but from comparison with Hough's section and with the descriptions given by both Hough and Sargent, I believe them to be of this species.

No. 122. DOGWOOD. Cornus Nuttalli. Aud.

PLATE IX. FIG. 76.

Natural Order. Cornaceæ.

Synonym. C. florida. Hook (in part).

Alternative Names. "Western Flowering Dogwood" (66).

Sources of Supply. United States of America, Canada.

Physical Characters, etc. Recorded dry-weight, 46 lbs. (49). I possess no further information, not having a solid specimen.

Grain. Extremely fine. Surface rather dull.

Bark. "Very smooth and of a grey-brown colour mottled whitish in patches. On very large trees it is of a red-brown colour checked on the surface into small, thin, appressed scales." (49).

Uses, etc. "Fairly abundant (in British Columbia), often attains a size of 12 inches in diameter, by 30 feet in height" (2). "Valuable for turnery, tool-handles, mallets, and metal-spinners' forms" (49). "A small slender tree rarely 45 m. in diameter, wood exceedingly hard and strong" (110).

Authorities. Macoun (66), p. 190. Anderson (2), p. 14. Hough (49), part viii. p. 38. Sargent (100), p. 91.

Colour. "Heart-wood red-brown, does not appear however until the tree is upwards of 40 to 50 years old: . . . the abundant sap-wood is of a creamy-white colour" (49). "Heart-wood pinkish" (2). "Light-brown tinged with red" (100).

Anatomical Characters. As in C. florida No. 121, but the pores are larger, size 4, and 40–65 per sq. mm., and the rays are smaller size 3–4. The pores are equally numerous in the Autumn wood though smaller than those of the Spring wood. These details are taken from a section by Hough.

No. 123. ELDER. Sambucus nigra. Linn.

PLATE IX. FIG. 77.

Natural Order. Caprifoliaceæ.

Alternative Names. Sureau noir in France (69). Schwartze Holder in Germany (131).

Sources of Supply. Europe, West Asia, North Africa.

Physical Characters, etc. Recorded dry-weight, 35½–64 lbs. per

cu. ft. Hardness Grade 4, compare Hornbeam. Smell none when dry, like rose-water when green. Taste rather astringent. Burns indifferently, flame readily dies out but the embers glow in still air and consume away to the ash. Solution with water or alcohol colourless.

Grain. Close, fine and dense. Surface of the ground somewhat lustrous.

Bark. Corky, velvety and pleasant to the touch : fissured deeply to the bast : about ⅛–½ inch thick.

Uses, etc. Turnery: " Difficult to dry, . . . much subject to splitting, . . . combs, etc." (69). " Tough, shrinks much, not very durable " (131).

Authorities. Hartig (42), pp. 31, 41. Schwartz (106), p. 482. Nördlinger (87), p. 530. Ditto (86), vol. iii. p. 75. Mathieu (69), p. 208. Wiesner (131), L. 12, p. 1007. A small tree seldom met with in logs of any size. Not readily confused with other woods.

Colour. Light yellowish heart-wood : sap-wood white, about ten rings wide. Nördlinger regards it as a sap-wood tree.

Anatomical Characters. Transverse section :—

Pores. Just visible, fine, size 5, somewhat variable in size but not larger in the Spring wood than elsewhere : crowded in all parts of the ring, especially in the Spring wood, where they are from 71–150 per mm. : in groups of 2–7 : a lightly branched or concentrically-waved arrangement in the outer part of the ring.

Rays. Just visible, medium, size 4, uniform : tapering gently at both ends : direct not avoiding the pores, much more than a pore width apart : very numerous, about 7 per mm. : very little denser than the ground-tissue.

Rings. Well marked on account of the pore-ring following the slightly less porous Autumn zone.

Soft-tissue. Rare, a few groups of cells usually arranged radially.

Pith. " Large, to 10 mm. diameter : round : white : of very coarse cells " (87).

Radial Section. Pores fine, colourless, almost imperceptible lines. Rays colourless, indistinct flakes. Rings not traceable.

Tangential Section. As the Radial, but the rays are practically imperceptible with lens.

Type specimens from trees known before felling.

No. 124. HACKIA. Ixora ferrea. Benth.

PLATE IX. FIG. 78.

Natural Order. Rubiaceæ.

Synonyms. Ixora triflorum. Benth. Siderodendron triflorum. Vahl. Siderodendrum triflorum. W.

HACKIA

Alternative Names. Lignum-vitæ (12). Iron-tree. Iron-wood.

Sources of Supply. British Guiana, West Indies.

Physical Characters, etc. Recorded dry-weight 51–59½ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn or rather harder. Smell when worked distinctly resembling Tuberose. Taste insipid. Burns well with some crackling : embers glow in still air : gives off a faint aroma : heat expels a brown juice. Solution with water or alcohol light brown.

Grain. Coarse and open. Surface lustrous.

Bark ? There are peculiar oval impressions in the wood immediately under the bark.

Uses, etc. " Mill-cogs, shafts, furniture, walking-sticks" (78). Almost unbreakable, splits readily and raggedly though straight. Planes badly by machine as it contains much grit which is bad for the cutting edge of tools. " A tree squaring 16–18 inches free of sap-wood by 65 ft. long" (78).

Colour. Uniform darkish to lightish brown in zones. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. Conspicuous from their size and colour, size 2, very coarse, little variation except in the groups : very evenly distributed, though sometimes collected into zones : some single, but many subdivided, radial groups of 1–4 or even 7 : groups sometimes crowded, appearing compound and irregular : much brown resin or gum : few 0–20 per mm.

Rays. Just visible, size 5, fine, uniform : equidistant, rather less than a large pore-width apart : very weak, running close round the pores : much denser than the ground : many 4–7 per mm. : light brown.

Rings. Doubtful : a zone-like appearance here and there, nothing definite.

Soft-tissue. Abundant, partly surrounding the pore-groups and sometimes connecting one or more : cells, size 7 (pore-scale), light brown.

Pith. ?

Radial Section. Pores prominent though not conspicuous : mostly empty : dully shining. Rays readily visible, inconspicuous, brown, crystalline flakes of the same colour as the ground. Rings not traceable. Soft-tissue prominent as rather lighter brown borders to the pores, giving the wood a hoary appearance.

Tangential Section. As the Radial, but the pores are more prominent on account of the frequent occurrence of a milk-white deposit. Rays very minute, brown lines about 1 mm. high, of one row of broad cells. Soft-tissue much more pro-

minent, covering half the surface of the wood and visibly coarse in texture.

Type specimens authenticated by the Forest Officer to the Government of British Guiana.

No. 125. DEGAME-WOOD. Calycophyllum candidissimum. DC. ?

PLATE IX. FIG. 79.

Natural Order. Rubiaceæ.

Alternative Name. Degame Lancewood.

Source of Supply. Cuba ?

Physical Characters, etc. Recorded dry-weight 49 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or taste none. Burns well with a lively spluttering flame: embers glow in still air, heat expels a red juice. Solution with water or alcohol almost colourless.

Grain. Very fine and dense. Surface bright, scarcely lustrous: the pores contain occasional minute, white, shining drops. Not sensibly cold to the touch.

Bark. ?

Uses, etc. Similar to those of Lancewood, with which it is almost always confused. Usually met with in the form of small logs or spars.

Colour. Uniform yellow. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. Need lens, size 4, rather fine, little variation: uniformly crowded, but tending to radial lines: single or in compact radial groups of as many as 8: numerous, about 150 per sq. mm.

Rays. Scarcely visible with the naked eye, size 5–6, uniform: equidistant, a pore-width or less apart: straight, not avoiding the pores: numerous, 7–10 per mm.: rarely tapering: less dense than the ground-tissue: white to brownish.

Rings. Very doubtful: a zone here and there poorer in pores: no line of contrast or other boundary.

Soft-tissue. Little: a few isolated cells here and there, but none in concentric lines or other definite form.

Pith. ?

Radial Section. Pores fine, colourless scratches: rays scarcely visible with the naked eye, minute, dull, white flakes: rings rarely traceable.

Tangential Section. As the Radial, but the rays are invisible even with lens: minute, colourless lines.

Type specimens from commercial sources, not authenticated.

The correct name of this wood is in some doubt. It is re-

puted to be as above, but there are not sufficient details in the literature of the subject to enable one to form a clear opinion.

No. 126. MANZANITA. Arctostaphylos pungens. H. B. et K.

PLATE IX. FIG. 80.

Natural Order. Ericaceæ.

Synonyms. A. Manzanita, Parry. A. Hookeri, H. B. et K. A. glauca, S. Wars.

Alternative Names. Californische Baerentraube, Busserole de Californie (49).

Source of Supply. United States of America.

Physical Characters, etc. Recorded dry-weight 59½ lbs. per cu. ft. Hardness Grade 7, compare Birch. Smell or taste none. Burns well and quietly, no smell. Solution with water a beautiful clear red.

Grain. Extremely fine though open. Surface lustrous.

Bark. Thin, about $\frac{1}{32}$ inch thick, leathery or skinny: red or chocolate in colour: smooth. "Annually exfoliating in thin, papery, curved scales" (49).

Uses, etc. Turnery, fancy-ware. A very beautiful wood. Splits easily and works well and freely. A small tree seldom yielding timber of any size.

Authorities. Hough (49), pt. vi. p. 33.

Not readily confused with any other wood.

Colour. Heart-wood: rich reddish-purple, usually with lighter streaks, gradually merging into the white sap-wood which is about 1 inch wide.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 5–6, diminishing regularly from the inner to the outer side of the ring: evenly distributed, finally sparing in the late Autumn wood: inclined to lines or short strings: very many 200–300 per sq. mm.: rarely subdivided, but some compact groups of 4–8: often with amber contents.

Rays. On the limit of vision, size 5–6: irregular in distribution, or else they taper to ends too fine to count: very short, apparently not crossing more than 1–3 rings: numerous, 6–17 per mm.: the fine ends a pore-width apart, but the thicker parts apparently widely separated and not avoiding the pores.

Rings. Very clear and definite: boundary, the porous Spring against the less porous Autumn zone, but no actual line: contour gently undulating.

Soft-tissue. None or only occasional cells.

Pith.?

Radial Section. Pores scarcely traceable with lens. Rays,

red shining flakes of darker colour, forming a pretty figure. Rings clear in lighter and darker loops and lines.

Tangential Section. As the Radial, but the rays need lens, about 0·5 mm. high.

Type specimens from commercial sources and also authenticated by Hough.

No. 127. MADRONA LAUREL. Arbutus Menziesii. Pursh.

PLATE IX. FIG. 81.

Natural Order. Ericaceæ.

Alternative Names. Strawberry-tree: Madrona (49). Madrona Madera (57).

Sources of Supply. North America, United States, Canada and Mexico.

Physical Characters, etc. Recorded dry-weight 44 (57) to 55 lbs. per cu. ft. Hardness Grade 4, compare Maple. Smell none when dry. Taste slightly astringent. Burns well with a quiet steady flame: embers glow brightly: very little ash. Solution with water reddish, darker than the wood: with alcohol afterwards, practically none.

Grain. Very fine, even and dense. Surface bright, chiefly due to the shining pores.

Bark. Red, leathery, quite smooth. "Brownish-grey, checked longitudinally and cross-wise with thin irregularly-oblong and square scales" (49). "By exfoliation, reddish" (66).

Uses, etc. Extremely tough: often badly grown with large faults due to the attacks of insects. "Apt to check and warp, if cut up before it is well seasoned, usually small but one has been measured which was 23 feet in girth at 3 feet from the ground" (49). "Charcoal for gunpowder" (100).

Authorities. Hough (49), pp. 6, 31. Anderson (2), p. 14. Macoun (66), p. 294. Kew Guide (57). Sargent (100), p. 166.

Colour. Heart-wood reddish-brown. Sap-wood "thin, pinkish, white" (49).

Anatomical Characters. Transverse section:—

Pores. Need lens, size 3 to 4: uniform: evenly distributed: a few rather larger in a single-rowed pore-ring: sometimes more numerous in the Spring zone than elsewhere: inclined to waved (in the Spring) or concentric (in the Autumn) lines or concave loops: not very numerous, 20–50 per mm: a few subdivided? radial groups of 2, 3 or 4 pores: round: empty.

Rays. Need lens, size 3: irregularly distributed: much more than a pore-width apart with attenuated ends: long: numerous,

5–6 per mm.: the tapered ends a pore-width apart, the thicker portions widely separated, not avoiding the pores: red.

Rings. Clear, not prominent: contour very irregularly undulating: boundary the rather more porous Spring zone, no line.

Soft-tissue. In indefinite patches imbedding the pores not encircling them but loosely connecting the groups.

Flecks? There are often imperfectly-healed insect galleries.

Pith. Irregularly oval, about 2–4 mm. diam. red or dark brown, coarse-celled, hard.

Radial Section. Pores need lens, minute, empty, shining grooves. Rays, just visible by contrast only. Rings, faintly indicated by a lighter-coloured margin.

Tangential Section. As the Radial, but the rays are minute, red lines, rather broad for their height, about 0·25 mm. high.

Type specimens authenticated by Hough.

No. 128. CAPE BEECH. Myrsine melanophleos. R. Br.

PLATE X. FIG. 82.

Natural Order. Myrsineæ.

Alternative Name. Beukenhout.

Source of Supply. South Africa, Natal.

Physical Characters, etc. Recorded dry-weight 39½–46 lbs. per cu. ft. Hardness Grade 4, compare Hornbeam. Smell and taste none. Burns well and quietly: embers glow in still air. Solution with water brown, darker than the wood.

Grain. Very fine, dense and even. The surface of the ground is the brightest portion, the prominent rays being dull.

Bark. ¼–⅜ inch thick, brownish, not deeply fissured, rugose from the large corky lenticels, otherwise smooth. Internally the bark shows the impressions of the rays, which are deeply marked. Pl. XIX. Fig. 165.

Uses, etc. "Wagons, . . . tough" (19). A wood of exceptional beauty, resembling that of Oak, but far excelling it. It works well and stands well without either cracking or warping.

Authorities. Nördlinger (86), vol. vii. p. 18. Cape Settlers' Almanac (19). Easily confused with Plane-tree and with New Zealand Honeysuckle woods.

Colour. Brownish relieved by prominent reddish silver-grain.

Anatomical Characters. Transverse section:—

Pores. *Readily visible though small, rather fine, size 4: evenly distributed in closed radial groups or nests in long rows between he rays and sometimes apparently within them: 10–23 groups 'r mm.: variable in size.*

Rays. Very prominent, size 2–3, increasing in breadth out-

wards, tapering inwards only: about 2 per mm.: red: coarsely cellular: gently undulating yet direct.

Rings. Vague: more readily perceptible in the solid: boundary a zone of rather more closely-packed pores: contour gently undulating.

Soft-tissue. Encircling the pores. All the ground-tissue is more or less spongy.

Pith. Rounded or bluntly-lobed.

Radial Section. Of great beauty owing to the large flakes of silver-grain, which are red in colour, the rays being often as much as ⅛ inch deep: the rings are not traceable.

Tangential Section. The meshes of the ground-tissue resemble the fibres of a Loofah, or as if the rays were threaded through a hank of flax. The pores are less visible than in the radial sec. and the rays are less striking but still prominent and are linear rather than spindle-shaped.

Type specimens authenticated by the Forest Officer to the Government of Natal.

No. 129. BULLETWOOD. Mimusops globosa. Gaertn.

PLATE X. FIG. 83.

Natural Order. Sapotaceæ.

Synonym. Mmiusops Balata. Crueg. Sapota Muelleri, Lind.

Alternative Names. Balata: Bully-tree: Bollitree. Melkhout (*see below*) in South Africa. Balata rouge in Surinam: possibly Pferdefleischholz (131). Balata saignant: Balata des Galibis (21). Baromé: Barueh: Purgo in Brazil (99).

Sources of Supply. British Guiana. West Indies.

Physical Characters, etc. Recorded dry-weight 63½–67½ lbs. cu. ft. Hardness Grade 1, compare Ebony. Smell and taste none. Burns well with much crackling but no smell: embers glow in still air. Solution with water deep crimson.

Grain. Moderately fine but open. Surface of the ground bright.

Bark. ?

Authorities. Wiesner (131), vol. vi. p. 131. Charpentier (21), p. 156. Saldanha da Gama (99).

Uses, etc. "Windmill-arms, posts, house-building, . . . very durable, stands exposure, suffers from teredo and worms, . . . polishes well" (78).

Colour. Deep red or flesh-red heart-wood not sharply defined from the brown sap-wood.

Anatomical Characters. Transverse section:—

Pores. Prominent from their masses, size 2–3, little variation:

irregulary distributed, tree-like on account of the radial groups being close together separated only by rays but at successively higher levels, thus appearing as long groups: the true groups are radial from 2-17 pores compactly arranged: pores rather numerous, 20–35 per sq. mm.: contrast little with the ground except when filled with white contents.

Rays. Need lens, size 5 or rather less, uniform: rather less than a large pore-width apart: weak otherwise straight: much denser than the ground: very numerous, 10-15 per mm. Rings doubtful unless indicated by the concentric lines of soft-tissue which however seem too much interrupted and irregular.

Soft-tissue. Abundant in concentric lines which are undulating, irregular and interrupted: brown: size 4-5 (ray-scale) and 4-5 per mm.: often mere angles or scraps: also encircling the pores and of a lighter colour than the lines.

Pith.?

Radial Section. Quite uniform in colour: pores very small but readily visible as hoary (not black) scratches with red contents: the rays are minute, obscure, shining flakes of the colour of the ground: the rings are not indicated.

Tangential Section. As the Radial, but the pores are apparently sinuous: the rays are minute, brown lines of one row of cells, visible with micro., after moistening (in the solid).

Type specimens authenticated by the Forest Officer to the Government of British Guiana. Boulger mentions Bulletwoods under the names of Lucuma mammosum and Sapota Muelleri. Neither appears to refer to this species.

No. 130. PERSIMMON-WOOD. Diospyros virginiana. Linn.

PLATE X. FIG. 84.

Natural Order. Ebenaceæ.

Alternative Names. Persimmons: Date-plum: Plaqueminier de Virginie (49).

Sources of Supply. North America: Japan.

Physical Characters, etc. Recorded dry-weight 45–53 lbs. per cu. ft. Hardness Grade 3, very hard, compare Blackthorn. Smell and taste none: burns well with a lively flame: embers glow in still air. Solution with water or alcohol colourless.

Grain. Open, of medium coarseness: dense. Surface scarcely bright.

Bark. Fissured deeply, ½ to 1½ inches thick: broken up into scaly lumps when old: dark brown like that of English Walnut: of 2 layers: the inner 1/16 inch thick, soft and corky.

Uses, etc. Shuttle-making, turnery, shoe-lasts, plane-stocks.

" A tree attaining a height of 70 to even 100 ft. by 24 inches in diam." (49). Splits with great difficulty.

Authorities. Nördlinger (86), vol. vii. p. 52. Hough (49), vol. iii. p. 25. Sargent (100), No. 184. Wiesner (131), L. 12, p. 991.

Colour. " Heart-wood dark or nearly black, only developed in very old specimens" (100). Sap-wood whitish-brown: brown: grey: usually with a cast of grey or greyish-green in irregular patches. " Very thick, upwards of 100 rings" (49). This sap-wood is the wood commonly met with in commerce.

Anatomical Characters. Transverse section:—

Pores. Readily visible in the pore-ring, rather fine, size 4, very variable: scattered uniformly or rather more numerous in the Spring wood in wide rings: few, 7–25 per mm.: here and there united in short radial lines of 2–5 pores together: appear light against the dark ground.

Rays. Just visible, fine, size 5, uniform: long, tapering very gradually: very numerous about 12 per mm.: direct but running round the larger pores: very little denser than the ground.

Rings. Clear on account of a coarser-pored Spring zone: contour well-rounded.

Soft-tissue. Obscurely and narrowly encircling the pores and in exceedingly fine, close, continuous, concentric lines, like fine shading at right-angles to the rays.

Pith. Yellowish, about 1 mm. wide.

Radial Section. Usually much lighter in shade than the trans. sec. Apparently coarser in grain owing to the pores being often exposed in parallel pairs, darker than the ground: rays visible in certain lights as minute flakes: rings only indicated by the recurring bands of pores: soft-tissue abundant in excessively fine vertical, whitish lines (lens).

Tangential Section. As the Radial, but the pore-bands appear finer and the Rays are indistinguishable with lens (need micro.). The rings are more or less vague loops and the soft-tissue runs in horizontal waved lines.

Type specimens from commercial sources and also authenticated by Hough.

No. 131. MARBLE EBONY (Madagascar) Diospyros sp.

PLATE X. FIG. 85.

Natural Order. Ebenaceæ.

Physical Characters, etc. Recorded dry-weight 49 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell none: taste slightly astringent. Burns well and quietly: embers glow brightly in still air: no resin expelled by heat. Solution with

water olive-brown : afterwards with alcohol more olive than brown, somewhat of a citron colour while it is being heated.

Grain. Fine, close, even and dense. Surface bright, lustrous when cleft.

Bark.?

Colour. Brown streaked with black, sometimes of a greenish cast. Sap-wood sharply defined from the heart-wood ; brown.

Anatomical Characters. Transverse section :—

Pores. Need lens but just visible by reflection in the black bands after moistening : size 2 ; groups scattered uniformly, scarcely any indication of zones : considerable variation : from 0–10 per sq. mm. in radially-disposed groups of 1-5 pores : black in the lighter bands.

Rays. Difficult to see even with lens : size 5 to 6, uniform : equidistant but apparently irregularly spaced : very numerous, 8 to 22 per mm. the attenuated ends occur in numbers together at intervals and avoid the pores : a pore-width or less apart, slightly lighter in colour than the ground, but of the same tint.

Rings. Doubtful or very obscure : the zones of colour are quite independent of the structure : contour scarcely to be spoken of.

Soft-tissue. Fine concentric lines, often interrupted and reduced to bars between the rays : size 6 or about that of the rays : visible in intense light with lens in the solid wood in the light wood only : coarsely cellular in transparent section as single rows of cells, each cell rather widely separated from the next.

Radial Section. Pores, visible as fine, dark lines, more or less filled with black resin in grains. Rays, readily visible when cleft as small, shining, crystalline flakes without contrast of colour. Rings, doubtful.

Tangential Section. As the Radial, but the rays are perceptible in the solid wood with lens only when moistened : they appear as fine darker lines about 0·25 mm. high.

Type specimen bears the label of the Madagascar (Sumbawa and Antalha) Forests Syndicate, Limited : not authenticated. As the rays of this wood are not red I conclude that the Madagascar Ebony described by Wiesner (131), L. 12, p. 989, as being derived from D. haplostylis Boiv. and D. microrhombus. Hiern. is another species.

No. 132. MACASSAR EBONY. Diospyros sp. (probably D. Ebenus).

PLATE X. FIG. 85.

Natural Order. Ebenaceæ.

Sources of Supply. India, Burmah, Straits Settlements, Malay Archipelago, and the West Indies.

Physical Characters, etc. Recorded dry-weight 61 lbs. per cu. ft. Hardness Grade 1, compare Black Ebony. Smell slight, like tan when worked. Taste none. Burns well without smell: embers glow in still air. Solution with water brown to claret-colour: alcohol extracts still more.

Grain. Rather fine: open or close according to the presence or absence of black contents. Surface bright, scarcely lustrous: pores reflect the light like mirrors when filled, especially when dried after moistening.

Bark. ?

Uses, etc. Turnery, cabinet-making, inlaying, Tunbridge-ware, etc. May be met with in logs 28 in. diameter by 20–30 ft. long. Usually confused with other Ebonies.

Colour. Mingled black and brown stripes: the black is in smoky (not jet-black), ill-defined, excentric, waved colour-bands (see Rings below). Sap-wood sharply defined from the heart-wood: brown, much like the lighter zones of the heart-wood.

Anatomical Characters. Transverse section:—

Pores. Visible in the black wood and even prominent, especially after moistening, owing to the reflection from the contents: size 2–3, little variation: scattered, collected more in some zones than others: few, 1–17 per sq. mm.: here and there in compact, radial, subdivided groups of 2–4 or more rarely 11: red as well as black resin at times.

Rays. Difficult to see, size 6, very fine: uniform: evenly distributed: too fine to taper: very numerous, 16–18 per mm.: lighter in colour and denser than the ground-tissue: direct, but running round the larger pores.

Rings. Doubtful, but many concentric zones of different shades independent of the structure: contour undulating and very irregular: neighbouring bands often meeting and again receding.

Soft-tissue. Fine concentric lines often interrupted or reduced to mere bars between the rays: equalling the rays in size: obscure in the solid: coarsely cellular in transparent section, equalling size 7 (pore-scale): very much waved.

Pith. Hard, about 2 mm. wide, angular: of very coarse cells.

Radial Section. Rather lighter in shade: pores readily visible, often shining: filled with black resin, sometimes in granules: rays, readily visible, shining plates (especially when cleft): rings, alternating bands of brown and black only.

Tangential Section. As the Radial, but the pores less numerous and narrower: rays, on the limit of vision with lens: under the micro. they appear as a single row of rather large cells: height about 1 mm.

Type specimens from commercial sources not authenticated.

but the wood is undoubtedly a Diospyros from its structure. It resembles the specimen in Museum No. 1, Kew, labelled D. Ebenus, but not that labelled D. Ebenaster.

No. 133. BLACK EBONY. Diospyros Dendo. Welw. (131)

PLATE X. FIG. 85.

Natural Order. Ebenaceæ.

Alternative Names. Billet-wood Ebony. Gaboon, Lagos, Calabar Ebony or Niger Ebony. These are trade names for different varieties, which are all evidently of the same species.

Source of Supply. Tropical West Africa.

Physical Characters, etc. Recorded dry-weight 72½ lbs. per cu. ft. Hardness Grade 1, the hardest next below Lignum Vitæ, but without its flinty character. Smell or taste none. Burns like coal, difficult to ignite, much crackling: the flame soon passes off, but the embers glow in still air. Solution with water yellowish-brown: requires caustic potash to extract the black pigment.

Grain. Rather fine: open or close, according to the presence or absence of black resin. Surface of the ground-tissue bright: pores dull when empty, reflecting when filled: rays of a coaly lustre: cold to the touch.

Bark. ?

Uses, etc. Turnery, inlaying, and all purposes where the colour is of value and where small size is no disadvantage. Usually met with in the form of small billets, made by splitting the heart-wood of the tree into 5 or 6 sectors.

Colour. Heart-wood black or black with brown streaks well defined from the brownish-white sap-wood.

Authorities. Wiesner (131), L. 12, p. 986.

Anatomical Characters. Transverse section :—

Pores. Just visible in the solid black wood (after moistening) by their reflection: size 4, rather fine, little variation: scattered but collected rather more in some zones than in others: few 2–9 or even fewer per sq. mm.: in compact radial groups of 1–4 or occasionally 11 pores: contents black and some few red.

Rays. Difficult to see even with micro.: very fine, size 6, uniform: evenly distributed, equidistant, running close round the pores: otherwise direct and more than a pore-width apart: 16–18 per mm.

Rings. Doubtful or rarely any contrast in colour except in Niger Ebony.

Soft-tissue. In fine, concentric lines, waved and rare: some-

times reduced to mere bars: "crystals of oxalate of lime at intervals" (131).

Pith.?

Radial Section. Pores fine, but still visible, showing up after moistening: filled with black resin, sometimes in grains. Rays readily visible when cleft.

Tangential Section. As the Radial, but the pores are less numerous and narrower. Rays invisible except in thin section under the micro.: height about 1 mm., of a single row of rather large cells: sometimes a larger cell where the ray is intersected by a line of soft-tissue.

Type specimens from commercial sources, not authenticated.

No. 134. EBONY. Diospyros melanoxylon. Roxb.

PLATE X. FIG. 85.

Natural Order. Ebenaceæ.

Synonyms. D. Wightiana, Bedd. D. Tupru, Buch. D. exsculpta, Ham. D. tomentosa, Roxb.

Alternative Names. For those in the Indian dialects, see Gamble (37), p. 247.

Sources of Supply. Throughout India (37).

Physical Characters, etc. Recorded dry-weight 61–82 lbs. per cu. ft.: the lower figure for the sap-wood only, I imagine, as my specimens all range much higher. Hardness Grade 1. Smell none. Taste of the sap-wood astringent or bitter, of the heart-wood less so. Burns well, little smell or smoke. Solution very faint brown, rather more extracted by alcohol.

Grain. Moderately fine and even. Surface bright, scarcely lustrous.

Bark. "Greyish-black, ⅓ inch thick: the inner substance black and charcoal-like with numerous transverse, rough cracks, exfoliating in regular oblong scales" (37).

Uses, etc. Cabinet-making, turnery, etc. "In India the sap-wood is used for shoulder-poles, building purposes, carriage-shafts and the Ebony for carving" (37). Splits readily and straight: planes easily compared with other Ebonies.

Authorities. Gamble (37), pp. 247–249. Nördlinger (86), vol. ix. p. 13. Nördlinger describes D. tomentosa as a separate species. This wood is usually confused with other Ebonies, from which it is difficult to separate unless some sap-wood be present.

Colour. Heart-wood black with brown or purplish streaks, sharply defined from the uniform pinkish or light-red sap-wood.

Anatomical Characters. Transverse section:—

Pores. On the limit of vision, size 3, medium: scattered

practically uniformly : no pore-ring : variable in size, especially within the groups, some groups contain very small pores : few 4–50 per mm., according to the subdivision of the groups, which are radial and sometimes two-rowed, and of 2–11 pores : clear only in the sap-wood, where there is sometimes resin.

Rays. Need lens, size 5–7 : uniform : equidistant, rather more than a pore-group apart : scarcely avoiding the pores, interrupted or running round them : very numerous, 8–23 per mm. : straight or gently waved : in the sap-wood much lighter than the ground and coarser-celled : obscure in the Ebony.

Rings. Not traceable, all indications quite absent, unless the clearer lines of soft-tissue occurring at intervals indicate them.

Soft-tissue. Needs lens, abundant in concentric lines or bars, size equals that of the rays (5–6 ray-scale) : the perfect lines chiefly in the Spring (?) zones, only bars in the later (?) wood : numerous, 6–8 per mm. : contour much serrated or jagged : equidistant.

Pith.?

Radial Section. Pores readily visible but scarcely prominent : usually filled. Rays inconspicuous yet readily visible, shining flakes of the colour of the ground. Rings not traceable : in the sap-wood the soft-tissue appears as excessively fine, continuous pink lines.

Tangential Section. As the Radial, but the rays in the sap-wood are on the limit of vision with lens, but clearer when moistened : about 0·5 mm. high : and the soft-tissue is not traceable.

Type specimens from commercial sources not authenticated, but checked by Nördlinger's description and section, and Gamble's description.

No. 135. ZWARTBAST. Royena lucida. Linn.

PLATE X. FIG. 85.

Natural Order. Ebenaceæ.

Alternative Name. Black-wood (57).

Sources of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 39 lbs. per cu. ft. My specimen has only a small proportion of the Ebony, hence the weight appears unduly low. Hardness of the Ebony Grade 2, compare Boxwood : of the lighter wood Grade 7, compare Beech. Smell or taste none. The lighter part of the wood burns well, heat expels a copious brown juice, embers glow dully in still air. Solution pale, the colour of the lighter wood : a brown ppt. upon the addition of potash.

Bark. Black, quite smooth and brittle like vulcanite: hard: about $\frac{1}{32}$ to $\frac{1}{16}$ inch thick.

Grain. Rather fine. Surface dull.

Uses, etc. "Well adapted for furniture, tools and screws, but is used chiefly for wagon-work . . . timber 40–50 ft. long by 1–2 ft. in diameter . . . tough" (57). Rather difficult to work: planes hard and badly.

Authorities. Kew Guide (57), p. 32. Nördlinger (86), vol. iv. p. 7.

Colour. Heart-wood dirty brown, with occasional pieces of Ebony, which are irregular in occurrence and shape, and are sharply cut off from the rest of the wood. "Earthy-yellow" (86). Sap-wood, 2½–3 in. wide, well defined from the heart-wood.

Anatomical Characters. As those of Diospyros melanoxylon, No. 134, but considerable variations, especially in the size of the elements.

Pores. On the limit of vision with a good lens, size 4, in characteristic radial groups of as many as 10: 40–60 per sq. mm.

Rays. Size 5–6: about 20 per mm.

Rings. Not prominent, but clear: boundary a line of contrast in the density of the ground-tissue here and there: scarcely visible.

Soft-tissue. As in other Ebonies, but needs a high power of magnification.

Pith. "Very small, angularly-round, partly filled with red contents" (86).

Radial Section. Pores, not visible except when filled with black pigment in the lighter-coloured wood. Rings scarcely visible.

Type specimen authenticated by the Forest Officer to the Government of Natal.

No. 136. OLIVE-WOOD. Olea europea. Linn.

PLATE X. FIG. 86.

Natural Order. Oleaceæ.

Synonym. O. verrucosa, Rafin. The O. europea of Thunberg is the O. verrucosa of Link.

Sources of Supply. Southern Europe. Cultivated in many other parts of the temperate zone.

Alternative Names. Olijf (de geweekte) (51) at the Cape of Good Hope. Oelbaum (131).

Physical Characters, etc. Recorded dry-weight 57–69½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell faint or none. Taste intensely bitter. Burns well, ignites readily, embers glow in still air. Solution faint brown.

Grain. Very fine, dense, even and smooth. Surface dull.

Bark. Brownish-grey, about ⅛–¼ inch thick, fissured into narrow, fibrous, thick-scaled ridges (49).

Uses, etc. Turnery, small articles of fancy-ware, such as pen-holders: a wood of very pretty figure: turns very well: splits badly, or rather crumbles under the knife.

Authorities. Nördlinger (86), vol. iii. p. 25. Hough (49), pt. viii. p. 29. Mathieu (69), p. 249. Wiesner (131), L. 12, p. 996.

Not easily confused with any other wood.

Colour. Yellowish-brown with varied bands of white passing through brown to black. Heart-wood not sharply defined from the yellowish sap-wood. "No apparent sap-wood" (69).

Anatomical Characters. Transverse section:—

Pores. Very small yet visible, fine, size 5, little variation: uniformly distributed: very many, 100–150 per sq. mm.: mostly in radial groups of 2–5 pores: a loosely branched arrangement may be discerned amongst the pores, which are joined by soft-tissue.

Rays. Need lens, size 5, fine, uniform: equidistant, short: very many, 10–12 per mm.: yellow or golden: less dense than the ground-tissue: not avoiding the pores, about a pore-width apart.

Rings. Very indistinct, not concentric with the dark bands: boundary, a zone with more crowded pores contrasted with a slightly less crowded one: contour rounded but irregular.

Soft-tissue. Abundant but difficult to make out: encircling the pores and joining them. It occupies a large proportion of the transverse surface.

Radial Section. Pores exceedingly fine: rings imperceptible, but the colour bands very striking. Rays imperceptible even with lens.

Tangential Section. As the Radial, but the rays are still more difficult to make out, being very minute lines.

Type specimens from commercial sources, not authenticated, but without doubt this species.

No. 137. BLACK IRONWOOD. Olea laurifolia. Lam.

PLATE X. FIG. 86.

Natural Order. Oleaceæ.

Synonyms. O. intermedia, Tausch. O. undulata, Jacq.

Alternative Names. Tamboti (12). Igqwanxe (61).

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 73½ lbs. per cu. ft. (My specimen is 55% sap-wood and 45% only of heart-

wood.) Hardness Grade 1, compare Ebony. Smell none when dry. Taste astringent. Burns with a long, crackling, smoky flame and a tarry smell: some brown gum expelled by heat: embers glow in still air. Solution olive-brown darkened by potash, but no ppt.

Uses, etc. "Good for turnery" (60). "A tree 40 to 70 ft. high by 2–3 ft. diameter, said to be nearly as durable and as suitable for heavy work as Lignum-vitæ . . . framework for wagons" (57). Saws hard but to a clean surface: not of the flinty hardness of Lignum-vitæ.

Authorities. Laslett (60), p. 304. Ditto (61), p. 438. Kew Guide (57), p. 35. Boulger (12), p. 418. Nördlinger (86), vol. vii. p. 51.

Colour. Light to dark brown, with streaks that are sometimes black: heart-wood sharply defined from the pinkish-brown sap-wood, which is from 1–3 inches wide even in the same tree: heart excentric and irregular in contour. "Light brown" (86).

Anatomical Characters. As those of Olea europea (No. 136), including the excentric smoky zones, but with the following differences:—

Pores. Few, 20–30 per sq. mm.

Rays. Size 5–6 and 9–12 per mm.

Soft-tissue. Encircling the pores, but not discernible with lens elsewhere.

Flecks. Numerous: narrow: very much lighter than the dark heart-wood.

No. 138. BLACK MAIRE. Olea Cunninghami. Hook., fil.

PLATE X. FIG. 87.

Natural Order. Oleaceæ.

Source of Supply. New Zealand only.

Alternative Names. Maire-rau-nui (91). The name Maire is applied to other species of Olea and also to Fusanus.

Physical Characters, etc. Recorded dry-weight 60–74½ lbs. per cu. ft. Hardness Grade 4, compare Maple. Smell none. Taste bitterly astringent. Burns very well, ignites readily: heat expels a brownish juice: no aroma: embers glow in still air. Solution faint olive-green slightly deepened by potash.

Grain. Fine, compact, dense and sinuous. Surface dull.

Bark. Rugged, nut-brown, ½–¾ inch thick, fissured, scaling in irregular, crumbling fragments: closely adherent to and difficult to detach from the wood: one layer: filled with large, coarse and conspicuous hard, white bodies.

Uses, etc. "Strong frame-work, . . . very durable, . . . not

plentiful and not much used " (24). " Timber up to 70 ft. long by 3-6 ft. in diameter. Celebrated for its strength and durability, . . . large engraving blocks, does not wear and bears extraordinary pressure without injury . . . bridges, wharfs, piers, . . . resists the teredo, . . . railway carriage building, bearings, ships' blocks and every purpose where great strength is required " (91). " Mill and wheelwork " (60).

Authorities. Perceval (91), pp. 14 and 48. Laslett (60), p. 311. Collinson (24). Kew Guide (57), p. 70.

Colour. " Heart-wood deep brown, generally striped with black " (91). Very irregular in contour and sharply defined from the sap-wood, which is brownish-white streaked with pink and about 2½–3½ inches wide.

Anatomical Characters. Transverse section :—

Pores. Visible, size 4, uniform : irregularly distributed in long tree-like, radially-straggling strings with poreless intervals : few, 0–20 *per mm.*

Rays. Need lens, very fine, size 5–6, uniform : equidistant : many, 12–15 per mm. : straight, not avoiding the pores : white.

Rings. Just visible : boundary a fine, white, gently undulating line, usually interrupting the strings of pores.

Soft-tissue. Abundant, imbedding and compacting the strings of pores : white : perhaps also the boundary-line.

Pith. ?

Radial Section. Pores, fine scratches, need lens. Rings, clearly visible, finely-cut lines. Soft-tissue, just visible, fine, white streaks. This probably gives the colour to the streaks in the sap-wood, where it is, however, pink.

Tangential Section. As the Radial, but the rays are minute lines about 0·2 mm. high, which require the microscope.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 139. WHITE MAIRE. Olea lanceolata. Hook.

PLATE X. FIG. 87.

Natural Order. Oleaceæ.

Source of Supply. New Zealand only.

Physical Characters, etc. Recorded dry-weight 53 lbs. per cu. ft. Hardness Grade 5, compare English Elm. Smell little or none. Taste rather bitter. Burns well with a crackling flame : embers glow in still air and consume exceptionally slowly. Solution faint brownish : a copious ppt. upon the addition of potash.

Grain. Fine, compact and dense.

Bark. Brown, about ½ inch wide, hard, rough, separating

externally in crumbling, irregular scales, full of readily visible but small hard, white bodies.

Uses, etc. "Like Ash and used for the same purposes, . . . not plentiful" (24).

Authority. Collinson (24).

Colour. Heart-wood dirty brown, streaky: well defined from the sap-wood, which is about 3 inches wide and marked with pinkish streaks and is quite pink in transverse section.

Anatomical Characters. As those of O. Cunninghami (No. 138), with the following variations:—

Pores. Prominent: 10–50 per sq. mm.

Ring-boundaries. Very clear, fine white lines, and rather prominent in the sap-wood.

Type specimen authenticated by the Forest Officer to the Government of New Zealand. The structure, though very similar to that of O. Cunninghami, is quite unlike that of O. europea or laurifolia.

No. 140. ENGLISH ASH. Fraxinus excelsior. Linn.

PLATE X. FIG. 88.

Natural Order. Oleaceæ.

Alternative Names. Common Ash. Europeesche Esche at the Cape of Good Hope (51). Hungarian Ash.

Distribution. Europe, North Africa: introduced into many other places.

Physical Characters, etc. Recorded dry-weight 52½–63½ lbs. per cu. ft. Hardness Grade 5, compare English Elm. Smell none when dry. "Like beet-root" (87). Burns well and quietly: embers glow in still air: heat expels an orange or red juice. Solution pale yellow.

Grain. Sinuous: open but not extremely coarse. Surface bright, "pearly, greasy to the touch" (69).

Bark. Grey: ashen: greenish or yellowish-grey for many years: deeply fissured when old: corky: of many fine concentric layers crossed by ray-like lines.

Uses, etc. Wagon-building, shafts, lances, hop-poles, tool-handles, etc. Tough and elastic. "Warps little: not very subject to the attacks of worms: more durable than Beech or Hornbeam, yet often decays rapidly enough in alternate wet and dry." (69).

Easily confused with American Ash.

Authorities. Nördlinger (87), p. 520. Ditto (86), vol. iii. p. 93. Laslett (60), p. 147. Holtzapffel (48), p. 73. Stevenson (113), p. 23. Westermeier (49), p. 2. Boppe (11), p. 72.

Schwartz (106), p. 483. De Mornay (70), p. 52. Mathieu (69), p. 241. Wiesner (131), L. 12, p. 992.

Colour. Heart-wood whitish-brown, pinkish or Oak-coloured. "Only present in trees over 40 years old" (131). Sap-wood very broad and white.

Anatomical Characters. Transverse section :—

Pores. Just visible with the unaided eye, size 2, variable, diminishing in size rather gradually from the inner to the outer side of the ring. Large pores of the pore-ring of 2-3 scanty rows deep, 8-12 per sq. mm. The smaller scattered uniformly, singly or in subdivided groups of 2-4 pores, branched or concentric, sometimes united in festoons or short lines on the *outer* side of the ring : elongated-oval.

Rays. Just visible, size 5, fine, uniform : equidistant : straight, avoiding the larger pores : scarcely denser than the ground-tissue and lighter in colour : many 7-12 per mm. : tapering at length, but very uniform in breadth : white.

Rings. Prominent : boundary, a line of contrast between the Spring and Autumn wood, accompanied by the conspicuous pore-ring.

Soft-tissue. Surrounding the outer pores and pore-groups and sometimes connecting them in well-grown rings.

Pith. About 5·0 mm. wide : five or six-sided or lobed.

Radial Section. Very prominent brownish lines, shining when empty. Rays scarcely visible with lens, except when moistened : faint, minute flakes. Rings prominent on account of the coarse bands of open pores.

Tangential Section. As the Radial, but the pores appear finer and form fringes to the loops which often extend far into the denser wood. Rays, scarcely perceptible with lens, minute, almost colourless lines from 0·1-0·5 mm. high.

Type specimens from trees known before felling.

No. 141. BLACK ASH. Fraxinus sambucifolia. Linn.

PLATE X. FIG. 88.

Natural Order. Oleaceæ.

Synonym. F. nigra. Marsh.

Alternative Names. Nova Scotia Ash. Ground Ash (100). Korbesche (113). Swamp Ash (66). Hoop Ash (49).

Sources of Supply. North America, Canada, Nova Scotia, United States of America.

Physical Characters, etc. Recorded dry-weight 38-44½ lbs. per cu. ft. Hardness Grade 6, compare Beech, Chestnut. Smell

and taste none. Burns well and quietly: embers glow in still air heat expels an orange-red juice. Solution faint, dirty brown.

Grain. Open: very coarse, about the same as English Ash. Surface bright, almost lustrous.

Bark. Very similar to that of the English Ash when the latter is old: 1 layer: not deeply fissured: reticulated in transverse section: "flaking off in thin scales" (100).

Uses, etc. "Furniture, interior-finishing, chair-bottoms, . . . splits into laths when bent in small sticks" (49). "Not strong: tough, compact, durable, separating easily into thin layers: . . . fencing, barrel-hoops, cabinet-making" (100).

Authorities. Sargent (100). Hough (49), vol. iii. p. 26. Macoun (66), p. 317. Wiesner (131), L. 6, p. 134.

Colour. Heart-wood, brown, of irregular contour, but well defined from the brownish-white sap-wood. Much lighter in shade in vertical section.

Anatomical Characters. Transverse section:—

Pores. Very prominent, size 1–2, rather coarse, very variable, diminishing abruptly outside the Spring pore-ring: large pores, 3–5 rows deep and 6–10 per sq. mm. Small pores in groups of as many as 7: 12–19 *per sq. mm.*

Rays. Need lens: 6–8 per mm.: brownish.

Radial Section. Rays minute, *brownish flakes*, faint, yet readily visible to the naked eye.

Tangential Section. The rings appear as bands or fringed loops of by no means coarse pores.

Type specimen authenticated by Hough and also from a log received from the Imperial Institute.

The structure is identical with the wood of F. excelsior in all other respects (*see* No. 140).

No. 142. AMERICAN ASH. Fraxinus americana. Linn.

PLATE X. FIG. 88.

Natural Order. Oleaceæ.

Synonyms. F. acuminata, Lam. F. canadensis, Mich. F. epiptera, Mich. F. americana, var. latifolia, Loud.

Alternative Names. Green Ash (113). Quebec Ash, United States Ash in England (60). White Ash (95). White River Ash in Canada (12). Mountain Ash in Newfoundland (12). Black Ash, White Ash in Nova Scotia (12) and in New Brunswick, where it bears also the name of Red Ash. Weissesche in Germany (131).

Sources of Supply. As indicated by the names given above.

Physical Characters, etc. Recorded dry-weight 37–52 lbs. per

cu. ft. Hardness Grade 5, compare English Ash. Smell and taste little, if any.

Grain. Very coarse and open in regular bands. Surface bright, often lustrous, with a kind of horny, natural polish on the denser bands when planed.

Bark. Corky, $\frac{3}{8}$–1 inch thick, fissured deeply : light brown : beautifully reticulated in transverse section.

Uses, etc. Chiefly as a substitute for English Ash, to which it is inferior : wagon-building, oars. "Very strong, stiff yet elastic, much easier to work than the English species : becomes brittle with age. Tough, elastic, . . . felloes, carriage-frames, cues, rods, handles, . . . the young wood much the best, . . . soon rots in the damp or in wet-and-dry" (95).

Authorities. Nördlinger (87), p. 520. Ditto (86), vol. i. p. 93. Hough (49), pt. i. p. 54. Laslett (60), p. 176. Holtzapffel (48), p. 73. Stevenson (113), p. 29. Sargent (100). Macoun (66), p. 317. C. Robb (95). Wiesner (191). L. 6, p. 133.

Colour. Brownish or light-reddish heart-wood, well defined from the nearly white sap-wood, of which one of my specimens has 29 rings.

Anatomical Characters. Transverse section. As F. excelsior, No. 140, with the following variations :—

Pores. Very prominent, size 1–2, rather coarse, very variable, diminishing (not very abruptly) from the Spring pore-ring outwards : large pores of pore-rings, 3–5 rows deep and 4–17 per sq. mm. : the smaller 12–20 per sq. mm.

Rings. Very prominent. *Boundary, a narrow line of dense Autumn wood* accompanied by the conspicuous ring of pores : *no other contrast between Spring and Autumn wood.*

Ground-tissue. Dense throughout the ring : uniform.

Flecks. Rare, like brown linear stains, $\frac{3}{16}$–$\frac{1}{4}$ inch long in the early Spring wood.

Pith. Oval : 1–1·5 mm. wide.

Type specimens authenticated by Hough and from commercial sources.

No. 143. ARKANSAS ASH. Fraxinus platycarpa. Michx.

PLATE X. FIG. 88.

Natural Order. Oleaceæ.

Synonyms. F. caroliniana, Mill. F. excelsior, Watt. F. americana, Marsh. F. pallida, Bosc. F. americana, var. caroliniana. Browne., etc, etc.

Alternative Names. Water Ash. American Ash (100).

Sources of Supply. North America, United States, West Indies.

Physical Characters, etc. Recorded dry-weight 35¾ lbs. per cu. ft. Hardness Grade 6, compare Chestnut or Beech. Smell or taste none.

Grain. Very coarse and open in bands, much more so than in other species of Ash. Surface dull.

Bark. ?

In all other respects as F. excelsior (No. 140).

Uses, etc. "Brittle, not strong" (100). Usually confused with other species of Ash, but readily distinguishable from them.

Colour. Milk-white or white tinged with yellow. Sap-wood lighter.

Authority. Sargent (100).

Anatomical Characters. Similar to those of F. excelsior (No. 140), and other species of Ash, which should be compared. Transverse section varies as follows :—

Pores. Very prominent, size 1–2, rather coarse, diminishing in size abruptly immediately outside the Spring pore-ring. Large pores close, 2–3 rows deep and 3–5 per sq. mm. : the small pores or groups scattered uniformly : rarely 3 in a group.

Rays. Need lens, size 5–6, and 6–9 per mm.

Ground-tissue. All very coarse and spongy throughout the width of the ring.

Radial Section. Lighter in shade than the transverse. Pores rather more prominent in this section than in the tangential.

Type specimen from commercial sources checked by Sargent's description.

No. 144. EAST-LONDON BOXWOOD. Gonioma Kamassi. E. Mey.

PLATE X. FIG. 89.

Natural Order. Apocynaceæ.

Alternative Names. Cape Boxwood : Kamassihout (71). Knysna Boxwood.

Sources of Supply. South Africa, Natal.

Physical Characters, etc. Recorded dry-weight 58 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn, or rather harder. Smell none. Taste faintly astringent. Burns well and quietly, the heat expels an orange-red juice, the embers glow in still air. Solution with water or alcohol light, clear yellow.

Grain. Very fine, dense and open. Surface bright, the rays and pores dull.

Bark. Brown, $\frac{3}{8}$–$\frac{7}{16}$ inch thick, fissured, scaling in flakes : ot two layers.

Uses, etc. As a substitute for Boxwood, and is usually confused with the straight-grained Boxwoods: "1–1½ ft. diameter: . . . veneering, tools" (19).

Authorities. Nördlinger (86), vol. vii. p. 28. Wiesner (131), p. 1002. Cape Settlers' Almanac (19).

Colour. Quite uniform light yellow. A sap-wood tree.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 4, almost uniform : evenly distributed : rather numerous, 60–240 per sq. mm. : an occasional narrow, irregular zone, poorer in pores : single or often in radial groups of large numbers.

Rays. Fine but clear in certain lights, size 5, uniform : equidistant : a pore-width or more apart : slightly undulating, otherwise straight, not avoiding the pores : considerably denser than the ground-tissue : white, tapering to long slender points (or else two sizes) : very numerous, 13–20 per mm.

Rings. Clear to the naked eye, but really rather vague : boundary, an indefinite narrow zone, poorer in pores.

Soft-tissue. Many isolated, scattered cells of larger size : irregularly scattered, 80–500 per sq. mm., easily mistaken for small pores.

Flakes. Sometimes present : very narrow lines.

Pith. Hexangular or six-lobed.

Radial Section. Uniform in colour, without alternation of light or dark bands : pores need lens, extremely fine lines : rays readily visible and slightly lighter in colour than the ground: white, much broader than in any true Boxwood. Rings vague and not often traceable.

Tangential Section. As the Radial, but the rays are vertical lines which are practically imperceptible on account of the lack of contrast : about ⅛ inch high : much deeper than in Buxus.

Type specimens from commercial sources checked by Nördlinger's section ; also from a log received from the Imperial Institute.

The structure of this wood strongly recalls that of the Celastraceæ, especially as regards the rays.

No. 145. SALIEHOUT. Buddleia salvifolia. Lam.

PLATE XI. FIG. 91.

Natural Order. Loganiaceæ.

Source of Supply. South Africa.

Alternative Names. Salie-wood (51). Umkaya (61). Unkaya (12).

Physical Characters, etc. Recorded dry-weight 54 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or

taste none. Burns well with faint aroma ; heat expels a brownish juice ; embers glow in still air ; little ash. Solution pale straw-colour deepened by potash : no ppt.

Grain. Fine and compact. Surface scarcely bright.

Bark. About ⅛ inch thick, of one layer, light brown, separating in thin, laminated, brittle scales : filled with white rod-like bodies.

Uses, etc. " A small shrubby tree from 15–20 feet high by 10–15 inches in diameter, . . . tough, . . . cabinet-making and teeth for mill-wheels, . . . said to be suitable for wood type " (57). " Tough . . . wagons, yokes, etc." (19).

Authorities. Kew Guide (57), p. 32. Laslett (61), p. 457. Nördlinger (86), vol. ix. p. 39. Cape Settlers' Almanac (19).

Colour. Reddish-brown.

Anatomical Characters. Transverse section :—

Pores. Visible from their masses not their size, Grade 3–4: no great variation except within the groups but a few widely-separated large pores in the early Spring-wood : chiefly in nested groups of as many as twelve united by the soft-tissue into wavy lines : few, 15–40 per sq. mm.

Rays. Need lens, size 5, uniform : broad in the middle and tapering to fine points both ends : " middles and ends " together 9–12 per mm., " middles " only widely separated, 2–3 per mm., the " ends " a large pore-width apart : lighter than the ground-tissue.

Rings. Clear : boundary a scanty pore-ring along a narrow line of soft-tissue.

Soft-tissue. The boundary-line and also imbedding and compacting the pores into the wavy lines.

Pith. ?

Vertical Sections. Pores, fine but readily visible scratches. Rays, minute, inconspicuous flakes which require the microscope and a transparent preparation in tangential section.

Type specimen authenticated by the Forest Officer to the Government of Natal.

No. 146. VLIER. Nuxia floribunda.

PLATE XI. FIG. 92.

Natural Order. Loganiaceæ.

Source of Supply. South Africa.

Alternative Name. Elder.

The only statement regarding this wood which I have seen (W. and E. vol. i., pt. 2), describes this wood as "light yellow tinged with pink, . . . used for felloes and schamels of wagons." This points to an error in the nomenclature somewhere.

Physical Characters, etc. Recorded dry-weight 60 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell or taste none. Burns well and quietly without aroma : a brown juice expelled by heat : embers glow in still air and consume very slowly. Solution light red commencing to appear immediately in cold water : much intensified by potash : a copious dark red ppt.

Grain. Very close, fine and compact. Surface bright and slightly cold to the touch.

Bark. Corky, resembling that of Boxwood but softer : fissured, brown with a leathery lining $\frac{1}{32}$ inch thick.

Uses, etc. A very good turners' wood : takes a good finish with ease. Saws freely, planes well and works generally much like Boxwood.

Colour. Uniform, deep, rich brownish red : purplish red. Sap-wood. ?

Anatomical Characters. Transverse section :—

Pores. Need strong lens, size 7, much variation, diminishing to vanishing point : widely scattered : few, 20–50 per mm. : the small pores cannot be seen without a microscope.

Rays. Just visible, size 5, uniform but tapering both ends to fine points : direct not avoiding the pores : red. In a transparent section they glow as though filled with ruby-coloured gum : irregularly spaced, " middles and ends " together 7–13 per mm.

Rings. Doubtful. *See further.*

Soft-tissue. Abundant and prominent in wavy, concentric ines resembling ring-boundaries, but which stop short of complete circles at times. Filled with ruby gum. As the largest pores are confined to these zones there is a possibility that they indicate the limit of the years' growth.

Pith. ?

Radial Section. Pores, need lens : extremely fine scratches. Rays just visible on a cleft surface. Soft-tissue, important though scarcely prominent : it gives the reddish tone to the wood and the vertical lines are seen with the lens to be very clearly marked off.

Type specimen authenticated by the Forest Officer to the Government of Cape Colony from a log sent to the Colonial and Indian Exhibition.

No. 147. PRINCE-WOOD. Cordia gerascanthus. Linn.

(Not of H. B. and K. or of Sw. The former is C. tinifolia and the latter C. gerascanthoides. H. B. and K. not Rich).

PLATE XI. FIG. 93.

Natural Order. Boragineæ.

Synonym. C. Geraschcanthus. Jacq.

Sources of Supply. Tropical America and the West Indies, chiefly Jamaica.

Alternative Names. Spanish Elm (8). Dominica Rosewood: Bois de Cypre: Bois de Roses. Bois de Rhodes (131). Claraiba in Brazil (76).

Physical Characters, etc. Recorded dry-weight 42–45 lbs. per cu. ft. Hardness Grade 6 compare Beech. "Hath a very sweet, pleasant smell almost like a rose" (8). Taste none. Burns very well: heat expels a juice: embers glow unusually brightly in still air: much ash. Solution faint pinkish-brown.

Grain. Rather coarse and open: "a very veiny wood of the grain of Elm" (8). Surface bright, but where the pores occupy much of the surface the effect is dull.

Bark.?

Uses, etc. "One of the best timber woods of Jamaica" (8). It is worthy of attention and would probably make a good paving wood when creasoted. It is not exactly an ornamental wood.

Authorities. Barham (8). Wiesner (131), L. 6, p. 137. Miers (76).

Colour. Brown with dusky excentric zones, otherwise uniform.

Anatomical Characters. Transverse section:—

Pores. Prominent from their size and masses, size 2: slightly more numerous and larger on the inner side of the ring; a loosely-waved, concentric arrangement visible with the unaided eye but not when magnified: many 10–15 per sq. mm.: subdivided, many pairs and also some with the divisions radially disposed: round when single.

Rays. Prominent, size 3: medium, uniform, equidistant, the width of a large pore apart, not avoiding them: firm; tapering: brown: 4–5 per mm.: occasional "false rays," i.e., large, conspicuous tails.

Rings. Apparently well defined, may be superficially confused with the dusky pigment-zones: contour regular: sometimes only a boundary line of soft-tissue but chiefly indicated by a smaller and rather more crowded zone or a loose pore-ring of larger pores.

Soft-tissue. Neatly encircling, and sometimes concentrically connecting the pores: of the same colour as the rays: also occasionally a fine boundary-like line.

Pith. Round, hard, blackish, about 1 mm. diam.

Radial Section. Slightly lighter in shade than the Transverse. Pores, readily visible, dull grooves. Rays, inconspicuous but

form a pretty silver-grain : readily visible, dull. Rings, doubtful but the dusky pigment-zones are prominent.

Tangential Section. As the Radial, but the rays are only just visible to good sight when the wood is moistened : about 1 mm. high.

Type specimen sent me by Messrs. Elder, Dempster & Co., authenticated by Sir Thomas Hughes.

I have followed Wiesner in the nomenclature which is very confusing. Miers describes the wood under the name of "Claraiba" (Cordia excelsa), and as his description tallies so closely with my specimen I have included that name.

No. 148. WEST INDIAN BOXWOOD (reputed to be Tabebuia pentaphylla. Hemsl.).

As Buxus, Plate XII. Fig. 105.

Natural Order. Bignoniaceæ.

Synonym. Tecoma pentaphylla. D.C.

Sources of Supply. West Indies, Brazil, Panama.

Alternative Names. Zapatero in England. White Cedar in Bermuda and the Windward Isles : Roble blanco in Cuba and Cogwood also in the Windward Isles (12). Poirier de la Martinique. Poirier blanc. Whitewood in Brazil (88). Amarilla yema de huevo. Dottergelb (131). Under a magnifying power of x 3 the appearance of this wood is the same as Buxus.

Physical Characters, etc. Recorded dry-weight 49–54½ lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell and taste none. Burns well: ignites slowly but embers glow in still air. Solution with water or alcohol colourless. Absorbs water unusually rapidly.

Grain. Fine, close, dense and even. Surface dull : smooth and cold to the touch. Curly wood and knots scarcely ever occur.

Bark. Yellowish, about ⅛ inch thick, *not fissured,* lenticels rare : usually much battered : sometimes exudes an unpleasant gum.

Uses, etc. Similar to those of the true Boxwoods for the inferior qualities which it serves very well. Very liable to split in drying : rends easily and straight. Usually met with in straight, cylindrical logs (with bark) up to 12 inches in diam., also in half-round flitches of inferior colour.

Authorities. Wiesner (13), L. 12, p. 999. Catalogue-Museum No. 1, Kew (57). Saldanha da Gama (99).

Colour. Uniform light yellow to brown. A sap-wood tree, no heart-wood.

Anatomical Characters. Transverse section :—

Pores. Need lens, fine, 5–6, almost uniform: evenly distributed throughout the ***whole width*** of the ring: very numerous, 200–400 per sq. mm.: in the solid wood they have the appearance of clinging to the rays.

Rays. Need lens, very fine, size 6, uniform: weak, running round the pores: long, very slightly denser than the ground-tissue and very difficult to see in the transparent section: numerous, 7–8 per mm.: more than a pore-width apart: white.

Rings. Doubtful. An occasional zone poorer in pores but not of necessity indicating the ring-boundary: little contrast of colour: always narrow, i.e. slowly grown.

Soft-tissue. None or only occasional wide-meshed cells.

Pith. *Round,* to 2 mm. diam. *Rarely perfect usually being destroyed by cracks* at the centre.

Radial Section. Pores need lens, practically indistinguishable as are also the rays except when the wood is cleft. The rings are quite indistinguishable.

Tangential Section. As the Radial, but the rings are a trifle clearer but still vague: the rays are fine lines about 0·2 mm. high.

Type specimens from commercial sources checked by the specimen in the Museum No. 1, Kew. I do not wish to question the accuracy of its nomenclature, but the structure of this wood is so unlike all the other species belonging to the same order which I have seen, that I think there may be an error somewhere. Wiesner says it is Aspidosperma Vargasii, D.C., but it totally disagrees with his description (p. 1000) of A. Quebracho in material particulars.

No. 149. TEAK. Tectona grandis. Linn. fil.

PLATE XI. FIG. 94.

Natural Order. Verbenaceæ.

Alternative Names. Indian Oak and many others in the Indian dialects, see Gamble (37).

Sources of Supply. Central and South India and Burmah (37). North Borneo.

Physical Characters, etc. Recorded dry-weight 34–55 lbs. per cu. ft. Hardness Grade 6, compare Oak. Smell characteristic and powerful, like old shoe-leather, very offensive when being worked. Gamble says " it has a pleasant and strong aromatic fragrance." Possibly it changes during drying. Burns well with a long lively flame and much crackling: embers do not glow in still air, but expire and leave the carbonized wood. Solution with water or alcohol brown.

Grain. Coarse and open, but much smooth wood in fast-grown timber. Surface, greasy to the touch, dull.

Bark. " " Grey, ½ inch thick, fibrous with shallow, longitudinal wrinkles, peeling off in long thin flakes " (37).

Uses, etc. Shipbuilding, railway-carriage building, etc. " Does not split, crack, warp or alter its shape when once seasoned, does not suffer in contact with iron, and is rarely if ever attacked by white ants " (37). Almost imperishable in some climates, as that of Japan. A very variable wood. The several varieties which are commonly met with in England suggest something more than a difference in the vigour of their growth. " Siam Teak is generally lighter in colour, and Malabar open in the grain and tough. Annamalay Teak is the narrow-ringed, brown (not golden or grey) stinking Teak " (109).

Authorities. Gamble (37), p. 283. Nördlinger (86), vol. iv. p. 44. Sinclair (109). Wiesner (131), L. 12, p. 1003.

Colour. Uniform dark golden-yellow : brown : greyish-brown. Sap-wood white or dirty-white.

Anatomical Characters. Transverse section :—

Pores. Very prominent, size 2, " large in the pore-ring, moderate-sized and small elsewhere " (37). Rather crowded in the pore-ring, 8–20 per sq. mm. in one or two rows : somewhat rarer in the later wood, 8–12 per sq. mm. : usually single, some pairs and groups of three or four : white deposit frequent. (Apatite, Calcium-phosphate. Ca. HPO_4) (131).

Rays. Just visible, medium, size 4, uniform : equidistant, weak but scarcely avoiding the pores : 4–6 per mm. : colour, a lighter brown than the ground.

Rings. Very clear on account of the dense pore-ring and looser Spring-wood following the denser tissue of Autumn.

Soft-tissue. " In patches between the Spring Pores " (86). Neatly encircling the pores, brown.

Pith. Large, quadrangular.

Radial Section. Pores well-marked, cellular grooves with finer ones between, often in pairs, bright when empty. Rays, well-marked dark flakes. Rings indicated by the bands of pores only.

Tangential Section. As the Radial, but the pores are as a rule much finer : rays fine lines on the limit of vision, being almost too narrow to taper : rings prominent as fringed loops.

Type specimens from commercial sources checked by Nördlinger's section and by the specimens in Museum No. 1, Kew.

No. 150. PURIRI. Vitex littoralis. A. Cunn. (not Decaisne).

PLATE XI. FIG. 95.

Natural Order. Verbenaceæ.

Alternative Name. New Zealand Teak (91).

Source of Supply. New Zealand only.

Physical Characters, etc. Recorded dry-weight 62½–76 lbs. per cu. ft. Hardness Grade 5, compare English Elm. Taste unpleasantly astringent though not strong. Smell not pleasant, rather like leather and reminiscent of Indian Teak. Burns badly with a spurting, explosive flame, ignites and supports a flame with difficulty: embers glow in still air and consume very slowly indeed to the ash. Solution faint-greenish or olive turning brandy-colour upon the addition of potash: no ppt.

Bark. Greyish-brown, about ⅛ inch thick, hard and fibrous: full of hard, whitish bodies. " Thin, smooth, greyish-white " (60).

Grain. Rather fine, though open: dense, compact and even. Surface somewhat lustrous.

Uses, etc. " Fencing-posts, piles, sleepers " (57). " Timber, 9–18 ft. long by 6–9 ft. in circumference, . . . generally free from defects, . . . very durable, suitable for the frames of ships " (60). My specimen log is riddled with large wormholes. " The strongest and most durable timber supplied by the Colony, and in order to split it, it needs blasting powder or dynamite. Suitable for purposes where immense strength and great powers of resistance are required " (91). Very tough and hard to work.

Authorities. Perceval (91), pp. 14 and 46. Laslett (60), p. 310. Kew Guide (57), p. 79.

Colour. Heart-wood dull, greyish-brown with a greenish tinge; not defined from the sap-wood which is about 1½ inches thick (at least in my specimen). " Dark-brownish " (91). " Sapwood 2–3 inches thick, and of a yellowish colour " (60).

Anatomical Characters. As those of Tectona grandis (Teak), No. 149, with the following differences:—

Pores. Of the pore-ring just visible, widely separated and scanty, never a continuous ring: 3–4 in a group: few, 6–10 per sq. mm.

Rays. Size, 4–5: 4–6 per mm. Rings obscure as is also the soft-tissue.

Radial Section. Pores readily visible, but not prominent. Rays: scarcely visible, and in Tangential section require the microscope.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 151. I-MIUGA. Halleria lucida. Linn.

PLATE XI. FIG. 96.

Natural Order. Scrophularineæ.

Synonym. H. elliptica. Thb.

Source of Supply. Tropical and South Africa.

Physical Characters, etc. Recorded dry-weight 52¼ lbs. per cu. ft. Hardness Grade 5, compare English Alder. Smell none. Taste slightly astringent. Burns well and quietly: an orange-coloured juice is expelled by heat: little or no aroma: embers glow in still air. Solution colourless: white ppt. upon the addition of potash.

Grain. Very fine and dense. Surface bright.

Bark. Cinnamon-brown, about ¼ inch thick separating in thin scales which are seen to be marked off till close against the wood, in alternate light and dark layers. Saws easily: planes easily and well, especially across-grain, i.e. transversely. It works something like Pear Wood.

Authority. Nördlinger (86), vol. viii. p. 29.

Colour. Brownish-white or écru. White (86). A sap-wood tree.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 4, little variation: irregularly scattered between the rays: single or in short groups of 2–7: few, 20–35 per sq. mm.

Rays. Readily visible, size 5, apparently two sizes, tapering to fine points both ends: "middles," 2–4 per mm., or "middles and ends" together, 14–17 per mm.: stout, not avoiding the pores: lighter and laxer than the ground-tissue.

Rings. Very doubtful, not easily made out with the lens though apparently clear on a not-too-smooth section.

Ground-tissue. Composed of cells almost as coarse as the smallest of the pores.

Pith. "Small, four-lobed, whitish" (86).

Radial Section. Pores, fine scratches. Rays inconspicuous, usually white or brownish flakes.

Tangential Section. As the Radial, but the rays need lens and are rather broad, spindle-shaped lines about 1·0 mm. high. Rings fairly evident as slightly darker loops.

Type specimens authenticated by the Forest Officer to the Government of Natal.

No. 152. STINK-WOOD. Ocotea bullata. E. Mey.

PLATE XI. FIG. 97.

Natural Order. Laurineæ.

Synonyms. Oreodaphne bullata. Nees. Laurus bullata. Burch.

Source of Supply. South Africa.

Alternative Names. Cape Walnut. Stinkhout. Cannibal Stinkwood (not Camdeboo Stinkwood): Witte or White Stink-

wood : Cape Laurel : Bean Trefoil : Laurel-wood : Hard Black Stinkwood (60). Soft-grey Stinkwood ? (61).

Physical Characters, etc. Dry-weight 51¾ lb. per cu. ft. Hardness Grade 2, compare Boxwood. Smell none when dry, even when worked : " strong and unpleasant when fresh felled." (60). Laslett says that it smells when worked but my specimens did not. Taste none. Burns badly: flame readily dies out: very little ash : unusually noisy : embers glow in still air. Solution brown like brandy.

Grain. Extremely fine, close, dense and smooth. Surface lustrous and cold to the touch ; exhibits much " fire " or phosphorescent lustre.

Bark. Leathery, brown, not fissured, about ¼ inch thick : covered with a cuticle on which are small, oval, clearly-visible lenticels.

Uses, etc. " Building purposes in South Africa " (60). It is the most beautiful dark-coloured wood that I have yet met with. It is to be hoped that it will be preserved from extinction as it is much better worth attention than many of the exotic trees which seem to be the favourites of Colonial foresters. " A substitute for Teak and equally durable, . . . wagons, cabinet-making, gun-stocks . . . extremely tough " (57). " Beams and planks, farm instruments, . . . 3–4 feet wide " (51).

Authorities. Nördlinger (86), vol. vii., p. 33. Wiesner (46), L. 6, p. 75. Boulger (12). Hutchins (51). Laslett (60), pp. 303, 305. Ditto (61), p. 440. Kew Guide (57), p. 32.

Colour. Dark walnut or reddish-brown to black : uniform. Sap-wood yellow, fairly well defined.

Anatomical Characters. Transverse section :—

Pores. Just visible in certain lights, rather coarse, size 1–2, little variation ; uniformly distributed, occupying the whole of the ring sometimes in loose lines : few 9–35 per sq. mm. rarely the latter : often sub-divided in groups of 2–4 or even 6, radial or concentric : some with dark contents.

Rays. Just visible, fine, size 5, uniform : long, tapering very gradually : many, 5–9 per mm. : more or less equidistant : less dense than the ground-tissue : weak, slightly avoiding the larger pores.

Rings. Rather obscure : discernible sometimes in a transparent section : boundary a line of contrast between the lax tissue of the inner part of each ring and the dense wood of the ring within : contour well-rounded.

Soft-tissue. Encircling the pores : also minute patches here and there.

Pith. ?

Radial Section. Slightly lighter in shade than the Transverse

section. Pores, narrow lines: fine except where a radial group is exposed. Rays, small lighter-coloured flakes. Rings, imperceptible.

Tangential Section. As the Radial, but the pores appear finer because they are exposed in smaller numbers. Rays, imperceptible with lens, about 0·5 mm. high.

Type specimens authenticated by the Forest Officer to the Government of the Cape of Good Hope: from logs sent to the Indian and Colonial Exhibition.

Laslett (61) says the Soft Grey Stinkwood is believed to be a variety. This is not the case; see Celtis Kraussiana, *No.* 175.

No. 153. MANGEAO. Litsea calicaris.

(Not mentioned in the *Index Kewensis.*)

PLATE XI. FIG. 98.

Natural Order. Laurineæ.

Synonym. Tetranthera calicaris. Hook. fil.

Source of Supply. New Zealand only.

Alternative Names. Mangeas (60). Tangeao (90).

Physical Characters, etc. Recorded dry-weight 48½ lbs. per cu. ft. Hardness Grade 7, compare English Alder. Smell delightfully fragrant and spicy when worked. Taste faint or none. Burns well: ignites readily but embers soon die out and leave the carbonized wood: little aroma. Solution very faint, turning pink upon the addition of potash: ppt. reddish-brown.

Bark. Brown, ¼–½ inch thick: of two layers, the outer rather soft and crumbling: fragrant when sawn: the inner about $\frac{1}{16}$ inch thick like a dark line following the undulating contour of the outside of the wood, which latter is deeply channelled.

Uses, etc. "Ships'-blocks" (60). "Tough, . . . seldom exceeds 40 feet in height" (57), p. 311.

Authorities. Laslett (60), p. 311. Perceval (91), p. 11. Kew Guide (57), p. 79.

Colour. Heart-wood écru: brownish white: defined from the darker sap-wood, which is from 2–2½ inches (or more) wide.

Anatomical Characters. As those of Ocotea bullata (No. 152) with the following differences:—

Pores. Just visible from their lighter colour, size 3: mostly empty: 8–15 per sq. mm.

Rays. Just visible on account of their white colour, size 5–6: firm, not avoiding the pores: 5–7 per mm.

Rings. Just traceable by means of a rather denser pore-less zone.

Soft-tissue. White borders encircling the pores.

Pith. ?

the width of the large pores apart yet scarcely avoiding them, gently undulating, long: scarcely denser than the ground-tissue: many, 4–6 per mm.

Rings. Rarely if ever traceable.

Soft-tissue. Encircling the pores and in very small lines and patches close to them.

Pith. ?

Radial Section. Much lighter than the Transverse section. Pores prominent in some sections as hoary lines or chambered grooves containing drops of dark-coloured resin. Rays very inconspicuous, small, dull flakes. Rings rarely traceable. Soft-tissue just visible as hoary borders to the pores.

Tangential Section. As the Radial, but the rays need lens, being minute lines about 0·5 mm. high.

Type specimens authenticated by the Forest Officer to the Government of British Guiana, also from commercial sources.

No. 155. YELLOW CIROUABALLI. Nectandra pisi. Miq.

PLATE XI. AS FIG. 99.

Natural Order. Laurineæ.

Alternative Names. Black Cedar (12). Yellow Siruaballi.

Sources of Supply. British Guiana and neighbouring regions.

Physical Characters, etc. Recorded dry-weight 52 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell when worked like certain kinds of Cedar or Callitris. Taste like spice with a suggestion of Havana (cigar-box) Cedar. Burns indifferently with much crackling: embers glow in still air but no resin is expelled by the heat. The flame will char the outside of a thin stick without burning through. Solution brownish.

Grain. Fine and even though open. Surface bright almost lustrous.

Bark. Smooth, reddish, about ¼ inch thick.

Uses, etc. "As planking for boats it is most durable" (78). It works well with all tools and turns especially well. It takes an excellent polish without much trouble but it cannot be called an ornamental wood.

Authorities. McTurk (78), No. 60. Boulger (12), p. 424.

The name "Black Cedar" applied to this species by Boulger probably belongs to Brown Cirouaballi, No. 157.

Colour. Light brown heart-wood gradually merging into the dirty-white sap-wood which is about 1 inch wide.

Anatomical Characters. Transverse section :—

Pores. Clear, scarcely prominent, rather coarse, size 1–2, little variation: evenly distributed but with a tendency to form

loose straggling lines : some single, mostly subdivided in compact groups of 4–5 pores : few, 9–15 per mm. : glisten at times.

Rays. Need lens, size 4–5, uniform : almost equidistant, slightly less than the width of the large pores apart which they lightly avoid, otherwise fairly straight : somewhat denser than the ground-tissue : many, 7–9 per mm.

Rings. Very regular bands of light and shade corresponding with certain zones of pores when they form straggling lines, but nothing of the nature of a boundary line.

Soft-tissue. Very little : narrowly encircling the pores and a few lines of single cells here and there.

Pith. ?

Radial Section. Much lighter in shade than the Transverse section, a greenish tinge occasionally. Pores rather prominent, coarse, colourless, cellular grooves containing drops of resin which look like silver beads. Rays visible in certain light, very inconspicuous flakes. Rings vague or rarely perceptible.

Tangential Section. As the Radial but a little darker in shade. Rays, minute lines on the limit of vision, about 0·5 mm. high.

Type specimens authenticated by the Forest Officer to the Government of British Guiana.

No. 156. TIMBER SWEET-WOOD. Nectandra exaltata. Griseb.

PLATE XII. FIG. 100.

Natural Order. Laurineæ.

Synonyms. In partim N. sanguinea. Griseb (not of Nees., or Rottb.).

Alternative Name. Boniato amarillo in Cuba (12).

Source of Supply. West Indies, chiefly Jamaica.

Physical Characters, etc. Recorded dry-weight 53 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell none. Taste bitter, unpleasant. Burns very well : no juice expelled by heat : embers glow very brightly in still air. Solution faint brown.

Grain. Rather fine and open. Surface lustrous.

Bark. ?

Uses, etc. "Interior work" (12). A dense, solid wood resembling Greenheart : liable to crack in the sun.

Authorities. Wiesner (131), L. p. 75. Boulger (12).

Colour. Brownish with a tinge of green. Cloudy, irregular zones at times.

Anatomical Characters. Transverse section :—

Pores. Prominent from their lighter-coloured masses, size 2–3, nearly uniform : evenly distributed : single or subdivided,

mostly pairs but occasionally fours: rather numerous, 10–20 per sq. mm.: a loose arrangement suggesting straggling, wavy lines to the unaided eye: round.

Rays. Just visible, size 3-4, uniform: equidistant: a pore-width apart, gently avoiding the larger pores, undulating: numerous 8–10 per mm.

Rings. Faintly indicated to the unaided eye but not with the lens: perhaps due to the rather closer arrangement of the pores in the Autumn zones: no definite boundary: contour regular.

Soft-tissue. Neatly encircling the pores but not joining them.

Pith. Round, hard, about 3 mm. diam.

Radial Section. Considerably lighter in shade than the Transverse. Pores readily visible, dull grooves. Rays, visible by contrast of lustre being dull against the bright ground. Rings not indicated.

Tangential Section. As the Radial, but the rays are minute, dark brown lines visible with micro.

Type specimen received from Messrs. Elder, Dempster and Co.: authenticated by Sir Thos. Hughes.

No. 157. KRETTI. Nectranda sp.

PLATE XII. FIG. 101.

Natural Order. Laurineæ.

Alternative Name. Keritee.

Source of Supply. British Guiana.

Physical Characters, etc. Recorded dry-weight 32 lbs. per cu. ft. Hardness Grade 5, compare Ash and Elm. Smell and taste resembling those of Cigar-box Cedar. Burns well with a lively flame and much crackling: heat expels a brown juice: embers glow in still air. Solution with water crimson, with alcohol brownish-red.

Grain. Moderately coarse and open. Surface lustrous, not cold to the touch.

Bark. About ¼ inch thick, resembling that of Sycamore but reddish in colour.

Uses, etc. "The upper planking of boats, partitions, etc" (78). It has a strong resemblance to some species of Cedrela, for example Havana Cedar, with which it can easily be confused. It works equally well with all tools and takes a good finish. Not ornamental. Can be obtained in logs 80 ft. by 20 in. free of sap-wood (78).

Authority. McTurk, No. 56 (78).

Colour. Heart-wood brown, gradually fading into the paler sap-wood, which is about 1–2 inches wide.

Anatomical Characters. Transverse section :—

As those of the Brown Cirouaballi, No. 158 which should be compared.

Pores. Readily visible on account of their large size, grade 1–2: rather coarse, fairly uniform : evenly distributed : some single, many subdivided into groups of as many as 7 : few, 9–15 per sq. mm. : oval : sometimes glistening.

Radial Section. Lighter in shade than the Transverse. Pores rather prominent though colourless : coarsely-cellular, containing drops of resin which look like silver beads. Rays, clearly visible though not at all conspicuous, reddish flakes ; bright.

Type specimens authenticated by the Forest Officer to the Government of British Guiana, from a log sent to the Colonial and Indian Exhibition.

No. 158. BROWN CIROUABALLI. Nectandra sp.

PLATE XI. AS FIG 99.

Natural Order. Laurineæ.

Alternative Name. Dark Cirouaballi or Sirouaballi.

Sources of Supply. British Guiana.

Physical Characters, etc. Recorded dry-weight 49½ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell none. Taste slightly astringent. Smell slightly resembling Sandalwood when sawn. Burns well with much crackling : heat expels drops of brown resin : embers glow in still air. Solution with water colourless, with alcohol pale brown.

Grain. Moderately coarse and open ; dense. Surface lustrous.

Bark. ?

Uses, etc. " Boat-building, for which it is specially adapted " (47). A serviceable though not very ornamental wood : turns exceptionally well and takes an excellent finish without trouble : planes smoothly in one direction : saws easily. Can be met with in logs up to 90 ft. long by 36 in. sq. (78).

Authority. McTurk (78), No. 50.

Colour. Dark brown with black here and there. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. Conspicuous (when the wood is scraped), on account of their size and colour : difficult to see when the wood is merely planed : size 1, coarse, little variation : evenly distributed : some single, many subdivided in groups up to 10 : few 9–22 per sq. mm. : oval : a suggestion of loose straggling lines : sometimes contain a dark resin.

Rays. Just visible, size 5, fine, uniform : equidistant, less than the width of the large pores apart, avoiding them, other-

wise straight, scarcely as dense as the ground-tissue: many 6–8 per mm.

Rings. Doubtful: zones of darker and lighter colour here and there and occasionally a zone of more closely-packed pores.

Soft-tissue. Very small lines or patches close to the pores or encircling them.

Pith. ?

Radial Section. Lighter in shade than the Transverse. Pores, prominent, dark, sometimes blackish lines: coarsely chambered and containing drops of dark resin. Rays, rather prominent but small, dark, dull, flakes.

Tangential Section. As the Radial, but the rays appear as minute dark lines about 0·5 mm. high (need lens).

Type specimen authenticated by the Forest Officer to the Government of British Guiana, from a log sent to the Colonial and Indian Exhibition. McTurk says that this wood is either a species of Nectandra or Oreodaphne but the former is more probably the correct name. The structure shows no affinity with Oreodaphne while it agrees well with several species of Nectandra in my collection.

No. 159. WAIBAIMA. Nectandra. sp.

PLATE XI. AS FIG. 99.

Natural Order. Laurineæ.

Source of Supply. British Guiana.

Physical Characters, etc. Recorded dry-weight 57 lbs. per cu. ft. Hardness Grade 2, compare Boxwood or Greenheart. Smell none. McTurk says, "a strong aromatic scent," but I think this is due to the bark, not to the wood itself He also mentions a "bitter taste," which is not very evident in my specimens. Burns well with a lively flame and much crackling: embers glow in still air. Solution bright green.

Grain. Very dense but coarse and open. Surface bright: scarcely lustrous: feels cold like Greenheart or Boxwood.

Bark. About ⅜ inch thick, composed of small roundish flakes or scales which easily become detached and expose others of varied colour from white to brown. A remarkable and unusual form.

Uses, etc. "Ship-building and all purposes for which Greenheart is used, and to which it is superior. The best wood of British Guiana for planking vessels, and as Greenheart is becoming scarcer Waibaima is worth attention. Abundant in the Colony." (78). It works well with all tools, more easily than Greenheart and takes an excellent finish without trouble.

Colour. Heart-wood green shading to brown, fairly well

defined from the reddish-white sap-wood which is about 1 inch wide.

Anatomical Characters. Transverse section :—

Pores. Conspicuous on account of their colour and size, Grade 1, coarse, little variation : evenly distributed : some single, mostly subdivided in compact groups of 2–4 : few 1–5 per sq. mm. : a tendency to loose, straggling lines. The contents swell up on exposure and feel like a fine rasp.

Rays. Readily visible, size 4, medium, uniform : equidistant slightly less than the width of the largest pores apart which they avoid but are otherwise nearly straight : long : less dense than the ground-tissue, quite spongy : many, 6–8 per mm.

Rings. Doubtful : vague bands of varying colour without corresponding difference in the structure.

Soft-tissue. Very narrowly encircling the pores : very obscure.

Pith ?

Radial Section. Colour, light yellowish-green, with a brown or golden shade here and there. Pores not prominent, being colourless but at the same time coarse. Rays, small, inconspicuous, whitish flakes : dull against the bright ground. Rings, vague bands of different shade here and there.

Tangential Section. As the radial, but the pores appear as whitish streaks. Rays, need lens and are then difficult to make out : minute, whitish lines about 0·5 mm. high.

Type specimen authenticated by the Forest Officer to the Government of British Guiana : from a log sent to the Colonial and Indian Exhibition.

No. 160. TAWA. Beilschmiedia Tawa. Bth. and Hook.

PLATE XVIII. FIG. 154.

Natural Order. Laurineæ.

Synonyms. Laurus Tawa, A. Cunn. L. Tama. Meissn. Nesodaphne Tawa. Hook.

Alternative Name. Taua.

Physical Characters, etc. Recorded dry-weight, 43¼ lbs. per cu. ft. Hardness Grade 7, compare English Birch. Smell little if any. Taste none. Burns well : embers glow in still air. Solution colourless : a dirty white ppt. upon the addition of potash.

Grain. Rather fine, open and straight. Surface dull.

Bark. $\frac{1}{16}$–⅛ inch thick, one layer, brown, brittle, separating easily from the wood : filled with very small, hard, round, white bodies.

Uses, etc "Not used in carpentry" (24). "Used at present

for fire-wood only" (59). "Useful for furniture work" (61). "A tree 60–70 ft. high by 1–2 ft. in diameter, . . . wood compact, suitable for furniture but not durable in exposed situations" (57). Saws and planes very easily but the surface of the wood tends to "pick up" in scales.

Authorities. Laslett (60), p. 311. Kew Guide (57), p. 78. Collinson (24). Kirk (59).

Colour. White or dirty-white. A sap-wood tree.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 3–4, uniform : thinly and evenly distributed : very few, 7–20 per sq. mm. : mostly single but many subdivided pairs, rarely threes.

Rays. Need lens. In appearance of two sizes, tapering to fine ends, size 5–6 : many "middles" 3–5 per mm. or together with "ends" 5–16 per mm : straight not avoiding the pores.

Rings. Clear not prominent : boundary a fine zone of darker wood accompanied by a finer and lighter-coloured line probably of soft-tissue.

Soft-tissue. Encircling the pores with a narrow, white border, and probably also the boundary line.

Pith. ?

Radial Section. Pores, fine scratches. Rays, narrow, dirty-brown lines, readily visible but not prominent. Ring-boundaries not very easily located.

Tangential Section. As the Radial, but the rays appear to be of two sizes if not of two kinds : pigmented. The rings appear as vague loops and lines.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 161. NEW ZEALAND HONEYSUCKLE.
Knightia excelsa. R. Br.

PLATE XVIII. FIG. 159.

Natural Order. Proteaceæ.

Alternate Name. Rewa-Rewa. The Honeysuckle, White or Coast Honeysuckle of Queensland, New South Wales and Victoria is a different tree (Banksia integrifolia. Linn. or Banksia marginata. Cav.). The wood mentioned by Laslett is probably one of these two.

Source of Supply. New Zealand only.

Physical Characters, etc. Dry-weight 46½–50½ lbs per cu. ft. Hardness Grade 4, compare Maple. Smell or taste none Burns well, ignites readily, no aroma : embers glow in still air. Solution brownish.

Grain. Very fine, even and close. Surface of the ground scarcely bright : that of the rays very dull.

Bark. ¼–⅜ inch thick, hard, smooth, not fissured, covered with pimples : separating in small thin papery scales. The rays are continued into the bark.

Uses, etc. " Marquetrie, cabinet-making, flooring, panelling " (91). " Not used in carpentry and joinery but frequently in fencing, as it splits easily : size of logs 4 ft. long by 18 inches in diameter " (24). Works easily.

Authorities. Perceval (91), p. 35. Laslett (60), pp. 249–411. Collins (24).

Colour. Light brown, brownish-white or reddish with dark lines.

Anatomical Characters. Transverse sections :—

Pores. Readily visible, size 3, medium, uniform : regularly distributed in concave loops between the rays (dentate) : pore-ring of one or at most two rows, no pores in the later wood : mostly in contact laterally : in compact, concentric or clustered groups of as many as 12 pores : few, 30–50 per sq. mm. : empty.

Rays. Very prominent, size 2, broad, apparently compound and of two sizes. The larger fairly equidistant, rarely less than 1 mm. apart : straight and direct : nodose : very lax yet denser than the ground-tissue : marked transversely with fine bars : sometimes separating outwardly into more than one smaller ray, i.e. forked. Smaller rays very weak : follow the contour of the nodes of the larger when close to them : bright : light red or brown.

Rings. Clear, distinctly visible. Boundary the pore-ring and its line of soft-tissue : contour finely dentate.

Soft-tissue. Abundant in concentric lines following the contour of the pore-ring : size about 5 : cells extended in a tangential direction, rectangular : brown.

Pith. ?

Radial Section. Lighter in shade than the Transverse section, pores very fine but readily visible being shown up by their borders of brown soft-tissue. Rays, bold, brown flakes resembling those of the Plane tree. Rings very clear. Soft-tissue in very fine light brown lines, close and parallel but often undulating.

Tangential Section. As the Radial, but the rays are bold spindle-shaped lines forming a reticulation with the ground-tissue : to about ¾ inch high by 0·5 mm. broad. The soft-tissue appears as small, light brown flakes resembling the silver grain of very fine-rayed wood.

Type specimen authenticated by the Forest Officer to the Government of New Zealand and also from commercial sources.

No. 162. SILKY OAK. Grevillea robusta. A. Cunn.

PLATE XII. FIG. 102.

Natural Order. Proteaceæ.

Synonyms. G. venusta. A. Cunn. G. Umbratica. A. Cunn.

Alternative Names. Tuggan-tuggan (5). Warra-garria. Koom-kabang (120). Grevillea (49).

Sources of Supply. South Queensland, New South Wales.

Physical Characters, etc. Dry-weight about 37¾ lbs. per cu. ft. Boulger gives the weight per cu. ft. as 35·25–38·8 lbs. and the specific gravity as ·564 only, thus making it appear that the weight varies while the specific gravity does not. Smell and taste none. Hardness Grade 6, compare Beech. Burns very well, ignites readily: embers glow in still air: heat expels a yellowish juice. Solution with water colourless.

Grain. Of medium coarseness, open and even. Surface lustrous or silky, the rays dull.

Bark. "Rugged" (5).

Uses, etc. "Elastic and durable" (131). "Staves for tallow-casks, cabinet-work" (5). "Interior-work, . . . becoming scarce" "May be met with in logs of 50–100 feet in length by even as much as 6–8 ft. in diameter" (111).

Authorities. F. M. Bailey (5), p. 117. Laslett (60), p. 255. J. Smith (111), p. 379. Nilson (85), p. 85. Wiesner (131), L. p. 70. *Timber Trades Journal* (120), June 6, 1903, p. 998. Hough (49), pt. ix. p. 35.

Colour. Pinkish to light-brown.

Anatomical Characters. Transverse section :—

Pores. Very clear, size 2, medium, uniform: evenly distributed in concave loops between the rays (dentate): a pore-ring of one or at most two rows: no pores in the later wood: isolated or in subdivided clusters of from 3–5; few, 5–12 per mm.: accompanied by a line of brown soft-tissue: round or if oval the long axis tangential: amber or ruby contents.

Rays. Conspicuous: size 2–3, apparently compound and of two sizes. Large ones fairly equidistant, rarely less than 1 mm. apart: straight and direct: nodose at long intervals: very lax yet denser than the ground: marked transversely with fine bars. Small rays avoid the pores: straggling, following the contour of the nodes of the larger when close to them: bright, light brown.

Rings. Clear and distinctly visible though fine: boundary the pore-ring and its loops: contour finely dentate.

Soft-tissue. Abundant in concentric lines following the pore-rings: joining the pores: size about 4: cells extended in a tangential direction, rectangular but minute: brown.

Radial Section. Of a lighter shade than the Transverse. Pores readily visible, mostly empty grooves of medium coarseness, often with a drop of yellow resin. Rays, broad, dull, bold, brownish flakes, resembling those of the Plane-tree. Rings not traceable.

Tangential Section. As the Radial, but the pores straggle out of their original plane at times. The rays are bold spindle-shaped lines forming a reticulation with the ground-tissue: about 7·0 mm. high by 0·5 broad.

Type specimen bears the label of the Technological Museum, Sydney.

No. 163. NATIVE PEAR. Xylomelum occidentale. R. Br.

PLATE XII. FIG. 102.

Natural Order. Proteaceæ.

Source of Supply. Western Australia.

The same popular name is applied to X. salicinum (5), X. pyriforme. Kn., and Hakea acicularis (57).

Physical Characters, etc. Recorded dry-weight 43½ lbs. per cu. ft. Hardness Grade 7, compare Birch. Smell none. Taste none or slightly astringent. Burns well, embers glow in still air. Solution with water or alcohol (cold), crimson; of deeper colour if hot. The colouring matter is almost entirely extracted. The wood would lose much of its fine colour if left exposed to the rain.

Grain. Rather coarse and open. Surface of the rays of a silky lustre, of the ground bright, of the pores dull. A beautiful play of light upon every part.

Bark. Coarse, fibrous, about ½ inch thick, deciduous, made up of strong, bristly fibres very lightly held together like the bristles of a broom and come away at a touch; dark red.

Uses, etc. An exceptionally beautiful wood. It combines a colour rivalling Mahogany with a figure more beautiful than that of Oak. Would be highly prized if obtainable of sufficient dimensions and properly seasoned. Liable to split if hurriedly dried: works well and easily with all tools: brittle: planes readily to a smooth surface.

Authorities. Kew Cat. (57), p. 72.

Colour. Blood-red: dark crimson to brownish-red heart-wood irregularly shaped, defined from the light-brown sap-wood which is from ½ to ¾ inch wide.

Anatomical Characters. Transverse section:—

Pores. Very clear from their size and colour: size 2–3, large, rather variable in no particular order: evenly distributed, single

or in irregular, isolated, few-pored groups between the large rays. Pore-ring not continuous: no pores in the later zones: few, 0–20 per sq. mm. accompanied by or strung upon a loop of soft-tissue: usually filled with dark resin and also some white deposit. The groups and pores not readily visible in the solid apart from the soft-tissue.

Rays. Of two kinds or sizes, magnificently conspicuous. The larger, size 00, exceptionally broad, compound, many-rowed: the cells visible with a good hand-lens, rectangular, extended radially, filled with a crimson pigment: fairly equidistant: not nodose: 1 mm. or so apart: gently curved: lax but denser than the ground: forking and tapering both ends occasionally: "tongued and grooved" into the part which penetrates the bark. Small rays extremely fine and few: rather thicker than a row of cells of the larger: scarce, weak and difficult to find in the solid: size 5–6: about 2 per mm.

Rings. Not very clear: discontinuous, vague, shaded bands.

Pith. Coarse-celled, about 1 mm. diameter.

Soft-tissue. In small rope-ladder-like, reddish loops between the larger rays connecting and imbedding the pores. Obscure in a transparent section but clear in the solid.

Radial Section. Pores, easily discernible though not prominent: follow the deviations of the mesh-like ground-tissue. Rays, magnificent, broad, crimson, shining flakes of exceptional beauty, like watered silk.

Tangential Section. As the Radial, but the rays appear as broad spindles interrupted and distorted by the ground-tissue: about 2½ or more inches high. The net-work of the rays and ground-tissue suggest the fibres of a "Loofah."

Type specimens authenticated by the Forest Officer to the Government of Western Australia.

No. 164. BANKSIA. Banksia littoralis. R. Br.

(Not of Lindley: this latter is the B. collina of R. Brown).

PLATE XII. FIG 102.

Alternative Name. Sea-side Banksia.

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight 43¾ lbs. per cu. ft. Hardness Grade 6, compare Ash. Smell faint if any. Taste none. Burns fairly well with a faint sickly smell and quiet flame: embers glow in still air: no resin expelled by heat: ash grey. Solution pinkish.

Grain. Very fine though open. Surface silky. The rays are dull in tangential section, but have a slight lustre in other sections. "Slightly sticky to the touch."

Bark. Rugged, brown, from ½–1 inch thick, corky: the inner layer forming an apparent transition from the woody tissue to the cork. The rays are easily traceable in the Radial as well as in the Transverse section.

Uses, etc. "A tree more ornamental than useful" (17). Height 24–40 feet: diameter 1 foot" (15). Very suitable for cabinet-making on account of the beauty of its figure.

Authorities. Ednie Brown (17). Boulger (15).

Colour. Reddish-brown heart-wood fading gradually into the whitish-brown sap-wood which is about 2½ inches wide.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 5, uniform: regularly distributed in concave loops (dentate) between the larger rays: pore-ring of one or two rows, closely arranged and compressed one against the other: no pores in the later wood: each loop a continuous cluster: few, about 60 per sq. mm. accompanied by a loop of soft-tissue, together appearing unusually conspicuous, the pores themselves as perforations only: often some white deposit.

Rays. Of two kinds. Conspicuous. The larger size 0, compounded of as many as 16 rows of cells: almost equidistant: nearly 1 mm. apart: slightly undulating: not nodose: very lax and of large rectangular cells coarser than the ground-tissue: tapering both ends without fringeing out. Smaller rays extremely fine, thinner by far than the single cell-rows of the larger, size 5–6, weak: hoary. The larger rays the colour of the wood but brighter.

Rings. Clear: unusually prominent on account of their colour. Boundary the pore-ring and its soft-tissue, which is as light-coloured as the rays: contour obscurely dentate and undulating. The colour is much aided by the white deposit in the pores.

Soft-tissue. Abundant, conspicuous in concentric lines following the pore-rings: actually a series of excessively fine, concentric lines of whitish cells.

Radial Section. Darker than the Transverse section: pores just visible, whitish, undulating, lines shining or filled with brown resin. Rays rather broad, conspicuous, soft-looking, red flakes, lustrous in certain lights. Rings indicated by the pore-lines and a line of soft-tissue.

Tangential Section. As the Radial, but the rays are broad, prominent spindles divided or interrupted, as it were, by the extremely irregular net-work of the ground-tissue: often distorted as though pushed aside.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 165. BEEFWOOD. Stenocarpus salignus. R. Br.

PLATE XVIII. FIG. 158.

Natural Order. Proteaceæ.

Alternative Names. Silky Oak: Silvery Oak (85). Many species belonging to this order and to the Casuarineæ pass under the name of Silky Oak or Beefwood. The latter name is also applied to several Sapotaceous woods.

Sources of Supply. South Queensland, New South Wales, Eastern Australia.

Physical Characters, etc. Recorded dry-weight 32–59½ lbs. per cu. ft. Hardness Grade 5–8. Smell none. Taste astringent. Burns well with a lively, noisy flame: little smoke, but a peculiar smell: no resin expelled by heat. Solution golden-brown.

Grain. Coarse and open. Surface of the ground-tissue lustrous, silky. Rays bright in transverse section, but dull in vertical section.

Bark. ? The ends of the rays appearing upon the outer surface of the log occupy about half the area exposed.

Uses, etc. "Cabinet-making, cooper's work" (5). "Splits readily, . . . the finer kinds of cooper's work" (78). A beautifully-marked wood of bold and pretty figure.

Authorities. F. M. Bailey (5), p. 119. Kew Cat. (57), pp. 49, 51. Nilson (85), p. 119. Boulger (12). Laslett (60), p. 256. C. Morris (78).

Colour. Deep red heart-wood. Sap-wood brown, about 1 inch wide.

Anatomical Characters. Transverse section :—

Pores. Readily visible from their size, Grade 2, uniform: regularly distributed in concave loops between the rays (dentate): pore-ring scarcely to be spoken of, a pore-group or two between each large ray alternating with zones of the later wood without pores: isolated or in sub-divided clusters, mostly single pores or pairs: few, 1–13 per sq. mm.: accompanied by or strung on a line of lighter-red soft-tissue: often ruby contents.

Rays. Conspicuous: bright in this section, size 2, broad: made up of rectangular cells in rows (as many as 13 rows), not two sizes (at least within the limits of my specimen): somewhat irregularly spaced: few, some 2 per mm. but mostly above 1 mm. apart: straight and direct, not nodose: very lax, cells coarse, about size 5: transparent and varying in colour: very dark red.

Rings. Clear with lens. Boundary the loop or ring of lighter red soft-tissue. Contour finely dentate.

Ground-tissue. Abundant in concentric lines enclosing and joining the few pores, size about Grade 7, cells round or compressed (squarish) of a lighter red colour than the ground.

Pith. ?

Radial Section. Rather lighter than the Transverse section. Pores, prominent, coarse and sinuous, often filled with black resin. Rays, bold, dark red, very dull, conspicuous flakes strongly resembling those of Grevillea robusta (see No. 162). Rings, not traceable. Plate XXIII. Fig. 182.

Tangential Section as the Radial, but the pores sometimes straggle out of their original plane being dislodged by the rays. Rays, large, dark-red, conspicuous, spindle-shaped bodies, dull and plainly spongy to the naked eye, forming a net-work with the ground-tissue: about 5 mm. high by 0·5 mm. broad. Plate XXI. Fig. 175.

Type specimens authenticated by F. M. Bailey and also by the Technological Museum, Sydney.

No. 166. AUSTRALIAN SANDALWOOD. Fusanus spicatus. R. Br.

PLATE XII. FIG. 104.

Natural Order. Santalaceæ.

Synonyms. F. spicatum. A. DC. F. Cygnorum Bth. Santalum cygnorum. Miq.

Physical Characters, etc. Recorded dry-weight 40½ lbs. per cu. ft. Hardness Grade 7, compare Alder. Smell characteristic, like burning "joss-sticks": overpowering and sickly when in quantity: soon passing off. Taste nauseous. Burns well, with lively flame: embers glow in still air: ash beautifully white. The aroma when burning is not exactly that which one expects from the smell of the wood. Solution with water colourless, with alcohol faint yellow.

Grain. Very fine but open, rather irregular. Surface dull.

Bark. Of one layer, hard, about ¼–½ inch thick: of the colour of Rosewood in section: fissured, rugged, dark brown, hard and crisp to the touch.

Uses, etc. Carving and the making of "joss-sticks". At present exported to China only.

Authorities. Laslett (60), p. 254. Ednie Brown (17), p. 17.

Colour. Yellow to brown: golden-yellow, streaked with dark lines similiar to Olive-wood. Heart-wood sharply defined from the écru sap-wood which is about ⅜–⅝ inch wide.

Anatomical Characters. Transverse section:—

Pores. Need lens, small and inconspicuous, size 5, a little regular diminution towards the outer side of the ring: rather evenly scattered: 70-100 per sq. mm.: mostly single ? if ever grouped or subdivided: no pore-ring: carmine contents visible here and there.

Rays. Just visible with lens, size 5–6, one size only : lack contrast of colour : short, not avoiding the pores : firm : reddish : about twice the width of a pore apart : denser than the ground : numerous, 9–14 per mm. undulating : tapering rapidly.

Rings. Apparently clear with the unaided eye but less so with lens : a denser zone of later wood which may or may not be poor in pores : the dark-coloured bands are sometimes excentric and have nothing to do with the structure.

Soft-tissue. Isolated cells only.

Pith.?

Radial Section. As dark or darker than the Transverse section, and the blackish stripes are more prominent. Pores need lens, fine striations, a few of which contain a rare drop of amber or crimson resin. Rays minute, obscure, reddish lines (scarcely flakes) almost needing microscope. Pigment-bands, prominent.

Tangential Section. As the Radial, but the rays are minute, red, spindle-shaped lines about 0·1 mm. or 6 cells deep, containing more red resin than the pores.

Type specimens from Western Australia and authenticated by the Forest Officer to the Government of that Colony.

No. 167. SANDALWOOD. Santalum album. Linn.

PLATE XII. FIG 103.

Natural Order. Santalaceæ.

Source of Supply. Malay Archipelago : India.

Alternative Names. For those in the Indian dialects see Gamble. Weisse or Gelbes Santalholz (131).

Physical Characters, etc. Recorded dry-weight 56 to 71 lbs. (37). Hardness Grade 6, compare Oak. Smell characteristic, strong and lasting, not sickly. Taste spicy at first, afterwards nauseous. Burns well with a powerful aroma and a crackling flame : embers glow dully in still air. Solution colourless : the alcoholic solution is turned brownish by potash.

Grain. Extremely fine and even. Surface bright.

Bark. "Dark grey, nearly black, rough with short, vertical cracks : inner substance dark red" (37).

Uses, etc. Fancy-ware and incense. The dust is mixed with the powdered bark of "Lignea Cassia" and swine's dung to make the well-known Chinese Joss-sticks (111). It is exported from India in the form "of billets, chips or dust, . . . used for making the coffins of the wealthy Chinese and also for the distillation of an essential oil" (37). The billets are usually from 3½ to 5 ft. long by 3½ to 10 inches wide.

Authorities. Gamble (37), new ed. p. 584-5. Smith (111), p. 365. Wiesner (131), p. 908. Kew Guide (57), p. 25.

Colour. Heart-wood cinnamon-brown. Sap-wood white (37).

Anatomical Characters. Transverse section :—

Pores. Visible from their numbers and colour, size 4 : from 12 to 20 per sq. mm.

Rays. Clear with lens : size 5 to 6 : from 5 to 9 per mm. : about a pore-width apart.

Rings. Clear to the unaided eye : no excentric, dark-coloured bands and no real boundary-line.

Soft-tissue. Encircling the pores and giving them their light yellow appearance.

Radial Section. The rays are narrow lines, inconspicuous yet readily visible.

There is no resemblance to Olive-wood. In other respects as Fusanus spicatus (see No. 166).

Type specimen from commercial sources. Not authenticated but no doubt this species.

No. 168. BOXWOOD. Buxus sempervirens. Linn.

PLATE XII. FIG. 105.

Natural Order. Euphorbiaceæ.

The B. sempervirens of Thunberg is B. Japonica and not the present species.

Alternative Names. English, Abassia, Turkish, Anatolian, Circassian, Corsican, Partheni, and Persian Boxwoods. Papri in the Indian Middle region (12). Buis commun in France (69).

Sources of Supply. Europe, Asia : as indicated by the names above.

Physical Characters. Recorded dry-weight 53-72 lbs. per cu. ft. My lightest specimen is of the Persian variety and my heaviest of the Turkish (67 lb.), but the maximum weight given is after Mathieu. Hardness Grade 2, compare Lilac. Smell none, taste slightly astringent. Burns well : ignites slowly but the embers glow in still air. Solution with water or alcohol colourless.

Grain. Extremely fine, close and dense. Surface cold and smooth to the touch especially in heavier samples. The lustre also increases in proportion to the density.

Bark. Very thin, about $\frac{1}{16}$ to $\frac{1}{8}$ inch : greyish : wrinkled rather than fissured, closely adherent, lenticels large and visible when the sticks are not too much battered, as they usually are.

Uses, etc. "Turnery, inlaying, wood-engraving, rules and instruments" (69). Rapidly being replaced by West Indian Boxwood except for the very best articles, on account of its increasing cost. Splits with great difficulty, takes a kind of natural polish. Always in small rugged pieces.

Authorities. Nördlinger (86), p. 514. Ditto (86), vol. iii. p. 42. Mathieu (69), p. 306. Laslett (60), p. 162. Gamble (37), p. 369. Hartig (42), p. 33. Boulger (12), Stevenson (113), p. 131. Wiesner (131), L. 12, p. 962.

Commonly confused with West Indian Box, from which it is not readily distinguishable when once worked up.

Colour. Light to dark yellow or brownish, in zones of lighter and darker shade. A sap-wood tree, no heart.

Anatomical Characters. Transverse section :—

Pores. Need lens, very fine, size 6, almost uniform : evenly scattered : numerous, 200-400 per sq. mm. : a narrow zone of Autumn wood without them : no groups, practically all single : round.

Rays. Need lens, very fine, size 6, uniform : straight, long : very slightly denser than the ground-tissue, difficult to see with lens in a transparent section : rather numerous, 5-11 per mm. : white : much more than a pore-width apart.

Rings. Clear. Boundary a narrow, pore-less zone of Autumn wood, little contrast except by depth of colour : always narrow, i.e. of slow growth.

Soft-tissue. Scattered cells perhaps in finely marked undulating lines (micro.). " In nests in the neighbourhood of the pores " (86).

Pith. Very small, about ·3–1·0 mm. diam., of a diamond, lozenge or winged shape : nearly always perfect. Plate XXII. Fig. 178.

Radial Section. A trifle lighter in shade than the Transverse. Pores need lens, practically imperceptible. Rays just visible with lens in certain lights. Rings indicated by variation in light and shade with a faint, fine line at the boundary.

Tangential Section. As the Radial, but the rays are imperceptible except with the microscope in any light.

Type specimens from commercial sources as regards the foreign woods, but from trees known before felling in the case of the English Boxwood.

No. 169. CAPE BOXWOOD. Buxus Macowani. Oliv.

PLATE XII. FIG. 105.

Natural Order. Euphorbiaceæ.

Alternative Name. East London Boxwood. Gonioma Kamassi also goes by this name (see No. 143).

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 74 lbs. per cu. ft. Hardness Grade 2, compare English Boxwood. Smell

or taste none. Burns well and quietly : embers glow in still air and consume very slowly. Solution colourless.

Grain. Smooth, fine, dense, even and cold to the touch. Surface indifferently bright.

Bark. About ⅛ inch thick, very hard. Two layers, the inner a dark ring, the outer brown, chalky, with vertical fissures. In Transverse section there are alternate brown and black layers : lenticels rare.

Uses, etc. Splits extremely easily and cleanly, may be cleft into thin plates. Usually met with in the form of small straight logs or sticks a few inches in diam., with bark still attached.

Colour and Anatomical Characters. Nearly identical with Buxus sempervirens, the European Boxwood, No. 168. Flecks may be occasionally met with as dusky, narrow lines or spots, apparently of two kinds. When present they are a distinctive mark.

Type specimens from commercial sources. Not authenticated but reputed to be this species.

No. 170. CHINESE BOXWOOD. Buxus sp.

PLATE XII. FIG. 105.

Natural Order. Euphorbiaceæ.

Physical Characters. As those of the European Boxwood except as regards the weight per cu. ft., for which I have no reliable data. A good, freely-working wood.

Grain. Extremely fine and dense. Surface lustrous.

Colour. Deep yellow approaching orange. No heart-wood.

Anatomical Characters, etc. As those of B. sempervirens with the following slight variations. Transverse section :—

Pores. Distinctly larger than in the Common Boxwood, No. 168, diminishing considerably in size towards the outer side of the ring and apparently in number also : numerous, about 90 per sq. mm. : a broad conspicuous zone of dark, pore-less wood : few if any subdivided.

Rays. Need lens, size 5–6 : straight : long : denser than the ground : visible with ease with the lens in transparent section : very many, 9-13 per mm.

Rings. Conspicuous on account of the dark zone, which is rather broad for a Boxwood and free from pores. My specimen has 10 rings per inch of radius.

Radial Section. Lighter in shade but more uniform in colour. Rings, very clear, though not prominent, lines of Autumn wood.

Type specimen from commercial sources. Not authenticated.

No. 171. AFRICAN OAK. Oldfieldia africana. Bth. and Hook.

PLATE XII. FIG. 106.

Natural Order. Euphorbiaceæ.

Alternative Name. African Teak.

Sources of Supply. Tropical Africa. Sierra Leone (107).

Physical Characters, etc. Recorded dry-weight 58½ to 68 lbs. per cu. ft. Hardness Grade, 2 compare Boxwood. Smell none. Taste strong and nauseous. Burns well with a quiet, steady flame: embers glow in still air: much ash. Solution brown: with water it gives off a peculiar smell.

Grain. Fine and open. Surface bright.

Bark. ?

Uses, etc. "For all strong work and one of the best woods of Sierra Leone" (107). "Rated second class at Lloyd's" (60). Laslett gives useful mechanical tests. This is not the African Oak commonly met with on the English market, which is Lophira elata. No. 6. The specimen from which this description is made is a piece sent me from Kew by the kindness of Sir Wm. Th. Dyer and is, I believe, from a block supplied by Laslett himself. I have never met with the wood elsewhere, and consider that it should be more generally used.

Authorities. Kew Guide (574). Laslett (60), p. 209. Scott-Elliot and Raisin (107).

Colour. Uniform dark brown. Sap-wood. ?

Anatomical Characters. Transverse section:—

Pores. Prominent from their numbers and colour, size 3-4, rather smaller in the outer side of the ring: uniformly distributed, not numerous, about 40 per sq. mm.: a few subdivided to groups of 3 or 4 but mostly single: oval: many contain a white deposit, others red.

Rays. Just visible, size 5-6, uniform: equidistant: weak, avoiding the pores (wriggling, so to speak): long: very numerous, about 12 per mm.: lighter in colour than the ground: a pore-width or less apart.

Rings. Very clearly marked: contour slightly undulating: boundary a zone of wood poor in pores, no distinct line.

Soft-tissue. Narrowly and neatly encircling the pores: also minute imperfect cross-bars (micro.), which in the later wood of the ring are sometimes developed into continuous, concentric lines finer than the rays.

Pith. ?

Radial Section. Pores just visible with lens as empty, shining grooves filled with white or red contents. Rays, imperceptible from lack of contrast. Rings, scarcely indicated.

Tangential Section. As the Radial, but the rays are extremely fine lines about 0·25 mm. high, rather coarse-celled (need micro.).

Type specimen see above (Uses, etc).

No. 172. COMMON ELM. Ulmus campestris. Linn.

PLATE XII. FIG. 107.

Natural Order. Urticaceæ.

Synonyms. Ulmus suberosa. Sm: U. glabra. Mill.

Alternative Names. Cork Elm (a variety): Orme rouge (69). Ipreau: Orme champêtre in France. European Elm in the U.S.A. Steinlinde in Germany, also Feldulme, Rothrüster and Glattrüster (131).

Physical Characters, etc. Recorded dry-weight 35-52½ lbs. per cu. ft. Hardness Grade 5, compare Ash or Holly. Smell none, taste astringent. Burns well, embers glow in still air. Solution with water faint brown.

Grain. Very coarse and open. Surface somewhat lustrous, the rays, however, dull.

Bark. Greyish-brown, dark, fissured but not deeply: corky: resembles that of Oak but is softer and of a lighter colour. The branches, especially of second-growth wood, are frequently winged with corky ridges.

Uses, etc. "Wheelwrights'-work especially naves, submerged-work, piles, pipes, pumps, keels and planking of ships below water and many other purposes. It is difficult to split, most durable under water and in dry places, but decays rapidly if exposed to the weather" (87). "Better than Ulmus montana (Wych Elm) or U. effusus: extraordinarily tenacious: as durable as Oak especially in wet places . . . dries slowly . . . shrinks 12% of its bulk, twists and warps" (69). It is employed by the makers of tin plates for packing as it does not discolour the goods. It is easily confused with the Wych and other Elms.

Authorities. Nördlinger (87), p. 543. Ditto (86), vol. iii. p. 103. Hartig (42), pp. 18, 39. Schwartz (106), p. 484. Stevenson (113), p. 33. Laslett (60), p. 153. De Mornay (70), p. 50. Boppe (11), p. 75. Westermeier (129). Mathieu (69), p. 29. Wiesner (130), p. 135. Ditto (131), L. 12, p. 901.

Colour. Dark brown or brownish-red heart-wood. Sap-wood white or yellow, "abundant, the more so in slowly-grown trees" (69): 10-20 rings (131).

Anatomical Characters. Transverse section:—

Pores. Clear from their size and also from their masses, size 2; great variation: a conspicuous pore-ring of two or more rows of large roundish-oval pores. The remainder of the ring occupied by small pores arranged in wavy lines or festoons *but not closely*

packed except in the outer part of the ring : gradually (i.e. not abruptly) decreasing outwards from the pore-ring : single or paired or in the late Autumn wood in closely-packed groups of 3–15 pores. The larger pores 10–12 per sq. mm. : smallest (excluding pore-ring) 20–90 per sq. mm.

Rays. Just visible, size 3–5, uniform : equidistant, rather less than the width of a large pore apart : direct but avoiding the larger pores : long, tapering : much denser than the ground-tissue : 5–7 per mm. : golden-brown.

Rings. Very clear on account of the broad zone of large pores which appears light brown in the solid wood : contour undulating.

Soft-tissue. Obscure : patches accompanying and joining the pores into the festoons.

Pith. About 1–2 mm. diam., rounded or obtusely lobed : white.

Radial Section. Golden-brown spotted with dark brown. Pores, prominent, deep, open, brown lines. Rays, prominent, small, dark brown flakes giving the wood a spotted appearance. Rings, conspicuous, as several rows of the pores are exposed in a continuous band.

Tangential Section. As the Radial, but more of the pores are exposed at a time. The rays appear as just visible, fine lines about 1 mm. high. The rings appear as conspicuously fringed loops and lines.

Type specimens from commercial sources and from trees known before felling.

No. 173. AMERICAN ELM. Ulmus americana. Linn.

PLATE XII. FIG. 108.

Natural Order. Urticaceæ.

Synonyms. U. alba. Rafin. U. floridana. Chap. U. mollefolia. Marsh.

Alternative Names. White Elm : Water Elm : Weisse Ulme : Orme parasol : Olmo blanco (49). Red or Nova Scotia Elm (12). Swamp Elm (95). Canada Elm (95).

Sources of Supply. North America : United States and Canada.

Physical Characters, etc. As U. Campestris (No. 171) with the following variations. Recorded dry-weight 35-41 lbs. per cu. ft.

Grain. Moderately fine and open. Surface dull without the caney appearance and feeling of the Rock Elm, but smoother.

Bark. "Light grey and rough with longitudinal and not very closely adherent ridges" (49).

Uses, etc. "Agricultural implements, tool-handles, wagon-

wheels especially the hubs, in cooperage and ship-building" (49). "Less valuable than the Rock Elm, durable when not exposed, . . . twists, shrinks much, warps . . . will take nails" (95). "Difficult to split . . . wheel-stock, saddle-trees, flooring, boats" (100). "To about 100 ft. high by 6 ft. diam. . . . tough . . . sheaves, gunwales, coffins . . . will withstand the driving of bolts . . . strong but not durable" (65).

Authorities. Hough (49), pt. ii. p. 22. Stevenson (113), p. 39. Laslett (60), p. 177. Sargent (100), No. 224. C. Robb (95), Macoun (65), p. 23. Wiesner (131), L. 6, p. 66.

Colour. Heart-wood light brown. Sap-wood yellowish white.

Anatomical Characters. Transverse section. (Compare U. Campestris, No. 172).

Pores. Clear from their masses not from their size (between 1 and 1-2). Nearly twice as long as broad, about 7 per sq. mm.: the remainder of the ring occupied by small, closely packed pores, size 3-4, in long wavy lines or festoons. These decrease perceptibly in size right up to the Autumn boundary, where they are about 160 per sq. mm.

Rays. Just visible, size 4, numerous, 6-8 per mm.: straight, not avoiding the pores: brown.

Rings. My specimen has 12 rings per inch. No contrast in colour.

Pith. ?

Radial Section. Much lighter in shade than the Transverse section: pores prominent and coarse though colourless lines: rays minute, dull-brown or whitish flakes: rings fairly evident as the pores of the pore-ring are regularly exposed.

Tangential Section. As the Radial, but the pores are much finer than in that section. The rings show as prominent lines and fringed loops of open pores. Other details as No. 171.

Type specimens from commercial sources, unauthenticated but reputed to be this species. ?

No. 174. ROCK ELM. Ulmus racemosa. D. Thomas.

PLATE XII. FIG. 108.

Natural Order. Urticaceæ.

Alternative Names. American Elm. Swamp Elm: Cliff Elm: Cork Elm: White Elm: Trauben Ulme: Orme à grappes: Olmo de Corcho (49).

Sources of Supply. North America: United States and Canada.

Physical Characters, etc. As Ulmus americana except:—Recorded dry-weight 43-45½ lbs. per cu. ft.

Grain. Very fine and close. Surface bright: feels like cane, and has a similar appearance in some sections.

Colour. Brownish heart-wood well defined from the brownish or dirty-white sap-wood.

Anatomical Characters. Transverse section :—

Pores. Clear on account of their size and also from their masses: size 2, great variation : a conspicuous pore-ring of a single, almost perfectly continuous row of large, oval pores (nearly 1½ times as long as broad) : the remainder of the Ring occupied by very small, closely-packed pores, size 4 to 5, in long wavy lines or festoons : these small pores decrease but little in size outwards.

Rays. Just visible, size 4, uniform : equidistant : the width of a large pore apart : many, 5 to 9 per mm. : long, tapering both ends : denser than the ground-tissue : brown : straight, not avoiding the pores.

Rings. Very clear. Boundary the conspicuous pore-line contrasted with the dense, small-pored Autumn wood. My specimen has 13 rings per inch. Contour undulating.

Soft tissue. In patches or isolated cells here and there near the Pores.

Pith. ?

Radial Section. Colour light brown with darker lines. Pores very prominent, open, coarse, brown lines. Rays pale, inconspicuous, narrow flakes. Rings fairly evident as the pores of the pore-ring are regularly exposed.

Tangential Section. As the Radial, but the colour inclines more to silvery or hoary-brown. Pores much finer though more are exposed at a time. Rays appear as minute lines (lens) about 0·5 mm. high. Rings, prominent brown lines and fringed loops with silvery fringes between.

Type specimens from commercial sources. Unauthenticated. I have given a specially full description of this species in the hope that it will lead to the identification of this useful wood. It is without doubt an Elm. Inquiries made of the Canadian authorities through the medium of Kew failed to elicit any information.

No. 176. CAMDEBOO STINK-WOOD. Celtis Kraussiana. Pursh.

PLATE XIII. FIG. 110.

Natural Order. Urticaceæ.

The synonym quoted by Wiesner, C. rhamnifolia, does not appear in the Index Kewensis. Charpentier calls it Rhamnus celtidifolia probably in error for R. celtifolia. Thb.

Alternative Names. Soft grey Stink-wood : Umvanuri (61). Um-Vumvu (Fourcade). Kamdeboo Stinkhout.

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 49¼–53 lbs. per

cu. ft. Hardness Grade 7, compare English Beech. Taste or smell none when dry. Burns rather badly but embers glow brightly in still air : heat expels a brown juice. Solution colourless : a white ppt. upon the addition of potash.

Bark. Yellowish-grey, $\frac{1}{16}$–$\frac{1}{4}$ inch thick, hard, compact, woody : 1 layer composed of alternate zones of hard, brownish bodies and a light-coloured tissue.

Grain. Rather fine and even, though open. Surface, slightly lustrous.

Uses, etc. "A tree about 20 ft. high by 2 ft. diam, . . . tough, . . . planks, axe-handles, fences, and coopers' work, yokes, poles and table-legs, . . . liable to warp" (57). "Railway-sleepers" (Fourcade). Saws rather firmly. Planes badly, for although a soft wood it "lugs," resists the knife and makes a rough surface.

Authorities. Wiesner (131), L. 6, p. 66. Laslett (60), p. 304. Ditto (61), p. 440. Kew Guide (51), p. 31 and 33. Charpentier (21), p. 137. Nördlinger (86), vol. vii. p. 68.

Colour. Greyish heart-wood well defined from the slightly lighter sap-wood, which is about 1 inch wide. "Dark greenish beautifully veined and very hard" ? (60). Light greenish-yellow (86).

Anatomical Characters. Transverse section :—

Pores. Need lens yet visible when moistened, size 2–3, much larger in the pore-ring than in the later wood : few, 10–15 per mm. scattered in small clusters. In slowly-grown wood there is little more than a succession of pore-rings.

Rays. Just visible, size 3, uniform though apparently of two sizes, tapering rapidly both ends to fine threads : many, 5–9 per mm. rather more than a large pore-width apart : bold, not avoiding the pores : of lighter colour than the ground-tissue.

Rings. Prominent (on a surface not too smooth) : boundary, the pore-ring accompanied by a whitish line finer than the rays : contour regular.

Soft-tissue. Encircling the pores and connecting those of the later wood in wide rings (like those of Fustic).

Pith. "White, bluntly-angular, about 1 mm. wide" (86).

Radial Section. Pores prominent on account of their numbers : fine, dark scratches. Rays just visible by contrast of lustre : brown on a cleft surface. Rings distinct, even prominent.

Tangential Section. As the Radial, but the rays are minute inconspicuous lines and the pore-rings appear as prominent fringed loops or lines.

Type specimens authenticated by the Forest Officer to the Government of Natal. The structure of this wood is similar to that of Chlorophora though the scantiness of the soft-tissue makes it appear unlike that species.

No. 177. FUSTIC. Chlorophora tinctoria. Gaudich.

PLATE XIII. FIG. 111.

Natural Order. Urticaceæ.

Synonyms. Maclura tinctoria. D. Don. Morus tinctoria. W.

Alternative Names. Fustick-wood. Palo Narango (lit., Orange-wood) in Trinidad and Fustete in Cuba (12). Bois jaune: Bois de Cuba in France. Tatajuba: Tatacajuba: Tatajiba in the Amazonas region and N. Prov. Brazil (76). Fiset holz: Gelbholz: Lignum citrinum (131). Dyer's Mulberry in Barbadoes (78). Tatajuba de tincta in Brazil (99). Futeiba: Gelbes Brasilholz (131).

Sources of Supply. Tropical America, West Indies.

Physical Characters, etc. Recorded dry-weight 39–46½ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell or taste none. Burns badly: no smell: embers glow in still air: Solution bright yellow.

Grain. Of medium fineness, even though open. Surface lustrous, satiny: has much "fire": that of the rays dull.

Bark. ?

Uses, etc. "Dyeing greens and yellows . . . mosaic, cabinet-making and turnery" (42). "Light and durable. Suitable for carriage-work and furniture" (37). Often confused by name with other woods sold for dyeing. Species of Zanthoxylon, Chloroxylon and Rhus are called Fustic. The wood of the Osage Orange or Bow-wood (Maclura aurantiaca. Mill) is sometimes substituted for this species, but differs as the pore-ring is "more conspicuous and the rays more beautiful" (131). Fustic may be met with in the form of hewn logs in the round from 2–4 feet long by 3–8 inches in diam.: usually of scraggy appearance.

Authorities. Laslett (60), p. 298. Holtzapffel (48), p. 85. Gamble (37), p. 32. Charpentier (21), p. 384. Miers (76). Henkel (46). Wiesner (131), p. 904. Saldanha da Gama (99).

Colour. Yellow: golden-yellow: greenish-yellow. Sap-wood pale.

Anatomical Characters. Transverse section:—

Pores. Conspicuous from their masses in light-coloured wavy lines, size 2–3, not much variation except in the groups: no continuous pore-ring but successive clusters joined by soft-tissue: clusters two pores wide, elongated radially, subdivided into as many as 11 (rarely so many): few, 10–20 per sq. mm.: contain thyloses.

Rays. Need lens, size 5–6, uniform: equidistant, the width of a large pore apart and only avoiding the clusters: nearly straight: many, 7–10 per mm.: slightly denser and of lighter colour than the ground: short.

Rings. Very prominent if indicated by the wavy lines: no other boundary.

Soft-tissue. Abundant in characteristic, conspicuous, concentric, wavy lines, size 2 (ray-scale), enclosing the pore-clusters in festoons which are built up of radial lines of cells.

Flecks. Probably present at times. My specimen shows a large one about ½ by $\frac{1}{16}$ inch, besides worm-holes.

Pith. ?

Radial Section. Rather lighter and brighter than the Transverse: pores rather prominent, rarely shining, being mostly filled with thyloses. Rays inconspicuous, dull flakes, very small. Rings appear as cloudy lines only, due to the soft-tissue.

Tangential Section. As the Radial, but the pores are obscured by borders of soft-tissue. Rings, cloudy, whitish, hoary loops. Soft-tissue very conspicuous.

Type specimens from commercial sources: not authenticated but checked by Nördlinger's section and by Miers' description. A variety, C. tinctoria var. xanthoxylon (Maclura xanthoxylon Endl.) is darker and more valued. It is called Amoreira de espinho branco, Palo narango and Bois d'orange (131).

No. 178. SNAKE-WOOD. Brosimum Aubletti. Sw.

PLATE XIII. FIG. 112.

Natural Order. Urticaceæ.

Synonym. Piratinera guianensis. Aubl.

Alternative Names. Letter-wood, Speckled-wood, Buro-Koro, Burracurra, Paira, Leopard-wood (99). Cangica (not Angica), Pae Rainha de listras in Guiana and the Amazonas region: Gamelleira preta in Pernambuco (76). Bois lezard in the Leeward Isles? (46). Gatia: Gateado in Brazil (99). Buchstabenholz, Tigerholz (131).

Source of Supply. Tropical America, chiefly British Guiana.

Physical Characters, etc. Recorded dry-weight 77–83 lbs. per cu. ft.: sinks like stone in water. Hardness Grade 1, compare Ebony. Smell none. Taste faint but insipid. Burns very badly with much crackling: embers glow in still air. Solution strong reddish-brown.

Grain. Moderately fine but close. Surface lustrous.

Bark. "Blueish" (76).

Uses, etc. Walking-sticks, inlaying, bows, etc. It is an extremely beautiful wood and takes a superb finish but it is already rare and is becoming more so. The heart-wood only is used but the sap-wood might be worth importing on its own account as it is very wide and would be valuable in small pieces for the same purposes as those for which Box-wood is used.

Authorities. McTurk, No. 57 (78). Holtzapffel (48), p. 106. Miers (76). Boulger (12). Wiesner (131), L. 12, p. 905. Saldanha da Gama (99).

Colour. Heart-wood nut-brown curiously mottled with black, sharply defined from the brownish-yellow sap-wood which is from 3½–6½ inches wide.

Anatomical Characters. Transverse section :—

Pores. Rather prominent, size 2–3, little variation : subdivided in groups of from 2–13 pores : not very numerous, from 10–17 per sq. mm. : filled with ruby or dark resin or curious thick-walled thyloses (131).

Rays. Need lens, fine, size 5, uniform : equidistant : numerous, from 9–11 per mm. : tapering both ends : denser than the ground-tissue : lightly avoiding the pores : brown.

Rings. Doubtful : a zone richer or poorer in pores here and there, no definite boundary.

Soft-tissue. Encircling the pores and extending laterally into wings : width equal to that of the rays.

Pith. ?

Radial Section. This is the section which shows the markings from which the popular names are derived. They are supposed to resemble the markings upon the skin of a snake. Pores, inconspicuous, though large, being lost amongst the black markings : usually filled with dark resin. Rays, fine, brown, narrow flakes : lustrous : abundant at times and obscuring the black zones in patches thus causing the patchy markings already referred to. Rings doubtful but the dark or black pigment zones are very prominent.

Tangential Section. As the Radial, but the effect caused by the rays is, of course, absent : the latter appear as minute, inconspicuous lines about 0·5 mm. high.

Type specimens authenticated by the Forest Officer to the Government of British Guiana.

No. 179. DEL. Artocarpus nobilis. Thw.

PLATE XIII. FIG. 113.

Natural Order. Urticaceæ.

Synonym. A pubescens. Moon. Cingalese name, Aludel.'

Source of Supply. Ceylon.

Physical Characters, etc. Recorded dry-weight 39½–50 lbs. per cu. ft. Hardness Grade 5, compare English Ash. Smell and taste none. Burns well and quietly : embers glow in still air : much ash. Solution with water yellowish-green.

Grain. Moderately fine, open and even. Surface of the ground has a beautiful metallic lustre.

Bark. ?

Uses, etc. "Canoes and furniture in Ceylon . . . a large tree" (37). A wood of good appearance but works badly being very cross-grained. The soft parts which alternate with the metallic green bands not only rip out but if required for finished work absorb much polish and make the process tedious.

Authorities. Gamble (37), p. 331.

Colour. Greenish or greenish-brown heart-wood. Sap-wood ?

Anatomical Characters. Transverse Section :—

Pores. Conspicuous from their size, Grade 2, little variation : uniformly distributed : few, 1–9 per sq. mm. : single, or sub-divided into compact groups of 2–4 : pores radial or clustered : appear white in the solid being sometimes filled with a white deposit.

Rays. Very distinct, size 5, uniform : nearly equidistant, the width of a large pore apart : weak, scarcely avoiding the pores but otherwise straight : numerous, 4–6 per mm. : denser and much lighter in colour than the ground-tissue.

Rings. Doubtful : no traceable boundary. Ground-tissue uniformly spongy, the cells are arranged in radial lines.

Soft-tissue. Conspicuous in patches partly imbedding and connecting the pores, sometimes as wings to them : resembles the spongy ground-tissue.

Pith. ?

Radial Section. Pores, prominent from their hoary borders and sometimes from their white contents. Rays, very clear on account of their white colour resembling that of the soft tissue. Small shining flakes. Neither rings nor soft-tissue traceable.

Tangential Section. As the Radial, but the rays are upon the limit of vision, minute lines about 2·0 mm. high.

Type specimens authenticated by the Forest Officer to the Government of Ceylon ; from a plank sent to the Colonial and Indian Exhibition. The sizes of the pores and of the rays given above scarcely tally with Gamble's description.

No. 180. THE JACK TREE. Artocarpus integrifolia. Linn.

PLATE XIII. FIG. 113.

Natural Order. Urticaceæ.

Alternative Names. For those in the various dialects of India see Gamble, p. 329. Jak-wood, Jaack-wood, Jaca-tree, etc. Kuthul : Orange-wood (48). Kos in Ceylon (37). Nangka buhriet (Timor) : Nangka (Malacca) : Nongko (Java). Tjoebadah kampong (Malacca, Sumbawa), Rappo tjedo (N. Java) (123). Jacqueira, Jaca, Brazil (76).

Synonyms. A. heterophylla, Lam. A. Jaca, Lam. A. maxima, Blanco. A. pubescens, Willd.

Sources of Supply. Throughout India, Ceylon: Malay Archipelago, West Indies, Brazil, Barbadoes.

Physical Characters, etc. Recorded dry-weight 35–44½ lbs. per cu. ft. Hardness Grade 6, compare Beech. Smell and taste none. Burns fairly well, embers glow in still air. Solution with water faint brown: with alcohol olive-brown, rather darker.

Grain. Very coarse but close: irregular, being soft and hard by turns. Surface, lustrous bands alternating with dull ones: the ground-tissue of an almost metallic lustre.

Bark. "Thick, blackish, deeply fissured" (37).

Uses, etc. "Carpentry, boxes and furniture in India: cabinet-making, and brush-backs in Europe: marquetry" (37). "Soft, brittle, and of no use for building" (64) in the West Indies. May be met with in logs from 3–5 ft. diameter and also in planks of similar width. Furnishes a yellow dye (12).

Authorities. Gamble (37), p. 329. Holtzapffel (48), p. 88. Boulger (12). Schomburgk (105). Van Eeden (123). J. Leman (64). Wiesner (131), L. 6, p. 68. Watt (127), vol. i. p. 332. Miers (76).

Colour. Yellow or rich yellowish-brown heart-wood. Darkens on exposure (37). Sap-wood ?.

Anatomical Characters. Transverse section:—

Pores. Conspicuous, size 1–2, little variation: uniformly distributed: few, 3–8 per sq. mm.: mostly single or in pairs, rarely more in a group: very slightly oval: appear white in the solid, being often filled with a white deposit.

Rays. Very distinct, size 4–5, uniform: nearly equidistant, the width of a large pore apart: straight, scarcely avoiding the pores: many, 4–7 per mm.: slightly denser and very much lighter than the ground-tissue.

Rings. Doubtful. No traceable boundary.

Soft-tissue. Rather abundant in prominent patches of irregular shape near the pores, and also in scattered threads of cells partly imbedding the pores and extending to short rings: very coarse-celled.

Pith.?

Radial Section. Of a metallic lustre. Pores conspicuous from their white contents, which give the wood a hoary appearance: chambers shorter than the width of the groove. Rays, very clear from their whitish colour, resembling that of the contents of the pores. Rings not traceable.

Tangential Section. As the radial, but the rays need lens and appear as clear, white, blunt lines about 0·5 high.

Type specimens authenticated by the Forest Officer to the

Government of Ceylon. From a plank sent to the Indian and Colonial Exhibition.

No. 181. THE WESTERN PLANE TREE. Platanus occidentalis. Linn. (not Hook).

PLATE XIII. FIG. 114.

Natural Order. Platanaceæ.

Alternative Names. Button-wood: Button-ball (49). Butter-wood, Plane, American Plane. Plataan (51) at the Cape of Good Hope. Californian Button-wood (12).

Sources of Supply. Southern Canada to the Gulf of Mexico.

Physical Characters, etc. Recorded dry-weight 28–41 lbs. per cu. ft. Hardness Grade 6, compare Beech. Smell or taste none when dry. Burns well: embers glow in still air. Solution with water brownish.

Grain. Compact, open and fine. Surface of the ground rather dull: of the rays, lustrous.

Bark. "Greenish: deciduous in large flakes, leaving the newly-exposed bark a whitish or greyish mottled colour. On the upper branches it is smooth and has a whitewashed appearance" (49).

Uses, etc. "Cabinet-making, fruit-baskets, tobacco-boxes, etc.: quay timbers" (49). "A clean wood, rather disposed to brittleness . . . furniture, screws, blocks" (95). "The largest tree of the Atlantic forests . . . not strong, difficult to split and work . . . ox-yokes, butchers' blocks, and (rarely) for cheap furniture: a tree 100–130 ft. high by 80–140 inches in diameter" (100). A wood of great beauty when quartered. Plane-tree wood, both Eastern and Western, may easily be confused with Honeysuckle (Knightia, No. 161) and Cape Beech (Myrsine, No. 128).

Authorities. Hough (49), pt. i. p. 59. Wiesner (131), L. 1, p. 78. Stevenson (113), p. 140. Laslett (60), p. 184. Du Mornay (70), p. 69. Holtzapffel (48), p. 101. Mathieu (69), p. 435. Robb (95). Sargent (100), No. 235.

Colour. Heart-wood of irregular contour, brownish, not sharply defined from the brownish-yellow sap-wood.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 5, somewhat variable: uniformly crowded throughout the ring, often almost monopolizing the space: smaller in the dense, late Autumn wood, but not so crowded: 150–200 per sq. mm.: not subdivided, but sometimes as many as 10 in a compact group.

Rays. Conspicuous, size 3, rather broad: few 1–2 per mm. long, tapering very much both ends, clearly spindle-shaped:

gently undulating : much denser than the ground-tissue : swelling at the boundary of each ring : uniform in size and regularly spaced, though apparently otherwise : lighter than the ground and shining.

Rings. Very clear in transparent section, but not always in the solid wood : boundary, a fine, clear line of Autumn wood, rather wider than the rays : contour regular.

Soft-tissue. Occasional cells only.

Pith. ?

Radial Section. Lighter in shade than the Transverse section. Pores just visible, a multitude of fine, shining scratches, covering the greater part of the surface. Rays very prominent and beautiful, lustrous, pinkish flakes, not sharply contrasting with the ground. Rings faintly indicated, more clearly traceable where they cross the rays, which seem to be darkened by them. This peculiarity is very noticeable in slowly grown wood.

Tangential Section. As the Radial, but the pores are rather less visible. Rays, short, light brown, broadly spindle-shaped lines, occupying about half of the entire surface : 1–2 mm. high by 0·2 mm. broad : cells not visible with lens. Rings inconspicuous, narrow bands or loops.

Type specimen authenticated by Hough ; also others from commercial sources.

No. 182. THE EASTERN PLANE TREE. Platanus orientalis. Linn.

PLATE XIII. FIG. 115.

Natural Order. Platanaceæ.

Synonym. P. acerifolia, Willd.

Alternative Names. Lace-wood : Maple-leaved Plane-tree : Platane d'Orient (69). Plataan at the Cape of Good Hope.

Sources of Supply. Europe and the Levant : North Coast of Africa.

Physical Characters, etc. Recorded dry-weight 30½.42 lbs. per cu. ft. Hardness Grade 8, compare White Pine. Smell none when dry : when green, " nach Rossdunger " (87). Taste very faintly astringent. Burns very well and quietly with a faint smell, embers glow in still air. Solution faint brownish.

Grain. Fine but open. Surface of the rays lustrous, but of the ground rather dull.

Bark. Greyish, deciduous in large flakes, leaving the newly-exposed bark in patches of varied colour.

Uses, etc. Cabinet-making, brush-backs, turnery. A wood of great beauty, " but durable only in dry situations " (87). " Less liable to decay in wet situations " (69). These contradictory

opinions suggest that the wood is perishable in alternate wet and dry. " Little or no value as timber " (60).

Authorities. Nördlinger (87), p. 528. Ditto (86), vol. iii. p. 56. De Mornay (70), p. 60. Stevenson (113), p. 138. Mathieu (69), p. 431. Holtzapffel (48), p. 101.

Colour. Yellow, brownish to dark brown heart-wood. Sapwood reddish-white, 15–20 rings wide, not very well defined from the heart-wood.

Anatomical Characters. As those of the Western Plane, No. 181, with the following variations :—

Rays. Brown : shining : can be separated from a thin section as tough fibres : size 3–4.

Rings. Often vague in transparent section.

Pores. Size 3–4.

Ring-boundary rather wider than the rays. The radial section is of the same shade as the transverse, with a much darker silver grain than in No. 180. This is composed of very conspicuous, lustrous, sharply-contrasting, brown flakes of great beauty.

Type specimens from commercial sources from North Africa checked by Nördlinger's section.

No. 183. WALNUT. Juglans regia. Linn.

PLATE XIII. FIG. 116.

Natural Order. Juglandaceæ.

Distribution. Europe and the temperate parts of Asia as far east as Persia.

Alternative Names. English, Italian, Circassian, Auvergne Walnut, etc. European Walnut in U.S.A. For names in the various Indian dialects, see Gamble and Watt.

Physical Characters, etc. Recorded dry-weight 28–49½ lbs. per cu. ft. Hardness Grade 6, compare Chestnut, Beech, or Oak. Smell none when dry. Taste faintly astringent. Burns well and quietly : embers glow in still air. Solution with water faint brown : afterwards with alcohol none

Grain. Open, fine to coarse : varies with the cut. Surface lustrous : somewhat cold to the touch.

Bark. Thick, deeply fissured with a hoary, smooth, leathery exterior : exhibits alternate bands of colour in radial section : smooth when young, with white lenticels.

Uses, etc. Cabinet-making, gun-stocks, turnery. " Tough and flexible " (68). Usually met with in the log as felled, or in waney-edged planks. " The Black Sea Walnut comes to hand in square waney-edged logs, 6–9 ft. long by 10–18 inches square : also burrs. The Italian in planks or ' thick-stuff,' 4–9 in. thick by 10–16 in. broad by 5–12 ft. long : also burrs " (60).

Authorities. Schwartz (106), p. 483. Hartig (42). Laslett (60), p. 146. Martin (68), p. 240. Nördlinger (87), p. 523. Ditto (86), vol. iii. p. 53. Mathieu (69), p. 310. Gamble (37), p. 392. Watt (127). Wiesner (113), L. 12, p. 883.

Colour. Dark brown, walnut to black heart-wood. Sap-wood yellowish, brownish, or dirty white.

Anatomical Characters. Transverse section :—

Pores. Readily visible from their size : grade 2 : somewhat variable, increasing in size as the tree ages : evenly distributed : few from 3–13 per sq. mm. : in most rings a distinct though loose pore-ring of 2–3 rows of pores : many subdivided groups of 2–5 pores in compact, radial groups.

Rays. Need lens, size 3–4, medium, uniform : straight, rarely avoiding the pores : rather short : much denser than the ground-tissue throughout the ring : numerous, 7–9 per mm. : tapering gradually : a pore-width or less apart.

Rings. Clear but not striking : obscure in the solid wood in dark specimens : boundary a fine line of wood scarcely wider than the rays : gently undulating.

Soft-tissue. In excessively fine lines, concentric and more or less continuous, very numerous and close : a much more prominent feature than in J. nigra : visible by reflected light only : also encircling the pores.

Pith. Cavity 2–5 mm. wide : round or lobed : contains a series of thin, flinty diaphragms.

Radial Section. Considerably lighter in shade than the Transverse : *never purplish.* Pores, open grooves, mostly black and shining. Rays, visible in certain lights, clear but not prominent. Ring-boundary line traceable with lens. Soft-tissue excessively fine, close, parallel lines (lens).

Tangential Section. As the Radial, but the boundary-line traceable by its lustre and by the fringes of the loops. Rays fine brown lines (lens), about 0·5 mm. high.

Type specimens from commercial sources and from trees known before felling.

No. 184. AMERICAN WALNUT. Juglans nigra. Linn.

PLATE XIII. FIG. 116.

Natural Order. Juglandaceæ.

The J. nigra of Thunberg is J. Sieboldiana, Max.

Sources of Supply. North America, United States and Canada.

Alternative Names. Black Walnut : Waney Black Walnut.

Physical Characters, etc. Recorded dry-weight 30–55 lbs. per cu. ft. Hardness Grade 6, firm, compare Chestnut, Beech or

English Walnut. Smell none. Taste faintly astringent. Burns well, somewhat noisily, embers glow in still air. Solution with water brownish : after with alcohol vinous reddish-brown.

Grain. Open, varies with the cut. Surface rather dull compared with the English wood : not so cold to the touch.

Bark. Deeply fissured.

Uses, etc. As those of the English Walnut. " Checks if not carefully seasoned : easily worked : susceptible of a beautiful polish : durable in contact with the soil " (100). " Very durable : not affected by worms . . . strong, tough, not liable to split" (95). " Fences, rails, shingles, boat-building " (40). " When worked up becomes more beautiful with age " (68).

Authorities. Laslett (60), p. 181. Nördlinger (87), p. 522. Ditto (86), vol. iii. p. 53. Hough (40), pt. ii. p. 24. Sargent (100). Robb (95). Martin (68). Wiesner (113), L. 12, p. 884.

This wood is readily confused with J. regia. " It is imported in logs of large size, from 15-30 inches square by 10-21 ft. long : imperfectly hewn with sap-wood, but without bark " (60). Inferior sorts are sent over in the form of planks and boards.

Colour. Heart-wood, dark brown to black, with frequently a tinge of *purple* in vertical section.

Anatomical Characters. As those of J. regia, No. 183. Perhaps the following differences may be more or less constant :—

Rays. In transverse section very slightly denser than the ground-tissue in the Spring and Autumn wood, but not denser than that of the Summer wood, in which they are difficult to detect. In radial section they are by no means clear, yet can be located in certain lights.

Rings. Boundary line just traceable with the lens by its darker shade.

The colour, lustre and the straightness of grain are the best guides for distinguishing this wood, but they must be learned by comparison with J. regia.

Type specimens from commercial sources : also authenticated by Hough.

No. 185. HICKORY. Carya sp. (probably amara).

PLATE XIII. FIG. 117.

Natural Order. Juglandaceæ.

Physical Characters, etc. Dry-weight about 50 lbs. per cu. ft. Hardness Grade 4, compare Maple. Smell or taste none. Burns fairly well with a long, steady, quiet flame : no aroma and no juice expelled by heat : embers glow in still air : ash brown. Solution extremely faint, brownish.

Grain. Very coarse and open. Surface bright.

Bark. ?

Uses, etc. Tools, handles, oars, and for purposes for which Ash is used. "Comes to market in the form of round logs 14-28 in. diameter by 12-18 ft. long. The dark wood is the best and strongest. The bark frequently betrays the quality of the wood" (Sinclair). This points to the fact that different species are imported without distinction of name. As the systematic name is uncertain, I have omitted many of the usual details: those given apply to my type specimen only.

Colour. Heart-wood of an almost uniform brown colour, with darker lines (the pores) sharply defined from the white sap-wood.

Anatomical Characters. Transverse section:—

Pores. Conspicuous from their size, Grade 00: very much larger in the loose, 1-rowed pore-ring than in the Autumn wood, where they rapidly diminish, but not to vanishing point: not much difference as the tree ages as in other Hickories: few 1-8 per sq. mm.: isolated single pores or in subdivided groups of 2-3: nearly round when single.

Rays. On the limit of vision, size 5-6: very weak, avoiding the pores: much less than a large pore-width apart, even as many as 3-5 within that space: very numerous, 6-9 per mm. Tapering to fine ends, which are about a pore-width apart.

Rings. Very clear: boundary the coarse pore-ring: contour undulating.

Soft tissue. Excessively fine, continuous, concentric white lines in the Autumn wood, much finer than the rays: also neatly and narrowly encircling the pores.

Pith.?

Radial Section. Pores conspicuous and coarse: grooves filled with glistening thyloses. Rays very inconspicuous, minute, colourless flakes. Rings not easily traceable. Soft-tissue visible with lens as borders and continuations to the pores, but the concentric lines are difficult to see even with the microscope (2 inch objective).

Type specimen from commercial sources, not authenticated.

No. 186. SHE-OAK. Casuarina Fraseriana. Miq.

PLATE X. FIG. 90.

Natural Order. Casuarineæ.

Source of Supply. Western Australia.

Physical Characters, etc. Recorded dry-weight 45½ lbs. per cu. ft. Hardness Grade 6, compare Beech. Smell none. Taste bitter. Burns fairly well with a lively, crackling flame and little smell: embers glow in still air: heat expels some juice: ash grey. Solution with water or alcohol yellow.

Grain. Fine, open, and of great beauty of figure. Surface of the ground lustrous, mottled with broad dull rays.

Bark. Deeply fissured, corky, about ¼ inch thick: light brown, rather hard: exhibits prominent rays, which are very striking in radial section, and are connected with the rays of the wood by a "tongue and groove."

Uses, etc. "One of the most elegant furniture woods, . . . shingles" (80). "Good furniture wood, . . . easy to split, . . . durable" (17). Saws hard, without smell: planes easily and smoothly. Requires care in seasoning, as it is liable to split to the heart: a wood well worth attention.

Authorities. F. von Mueller (80), p. 15. Bailey (5). Brown (17). Sometimes confused with Oak, and frequently with C. torulosa and other She-Oaks.

Colour. Reddish-white, light red, pinkish: well defined from, though not strongly contrasting with, the light brown sap-wood, which is from 1–1½ inches wide.

Anatomical Characters. Transverse section:—

Pores. Need lens, very inconspicuous, size 2–3: considerable variation in the ring, and increasing a little in size as the tree ages: irregularly distributed, scarcely more than a suggestion of the dendritic form: few 0–20 per sq. mm.: single, isolated: appear as perforations: *not confined to one part of the ring:* often strung upon the lines of soft-tissue like beads, but in ones and twos, not as continuous loops of pores.

Rays. Two sizes, the larger very striking, the smaller fine and obscure: large rays, size 00, widening continually outwards to over 2 mm. wide: tongued-and-grooved into the rays of the bark: few 10–12 per *inch:* similar in colour but more lustrous than the ground: not very large-celled, but very many-rowed: enclosed pores doubtful or rare. The small rays a pore-width apart, very fine, size 5–6: 12–15 per mm.

Rings. Apparently prominent, but really vague: the different spacing of the lines of the soft-tissue may indicate the boundaries.

Soft-tissue. Prominent in fine white or brown lines, concentrically connecting the larger rays: coarse celled: convex outwards (crenate), connecting the pores in a string: also encircling the pores.

Radial Section. Pores scarce, dully shining lines, occasionally sinuous. Rays unusually prominent, dull, rather deeper coloured broad flakes. Rings not indicated.

Tangential Section. As the Radial, but the rays instead of being flakes are prominent, considerably deeper-coloured, frequently-interrupted spindles apout 1½ inches high. In this section they appear to distort the fibres of the ground-tissue as though they were threaded through them.

Type specimen authenticated by the Forest Officer to the Government of Western Australia.

No. 187. FOREST OAK. Casuarina torulosa. Ait. (not Miq.)

PLATE X. FIG. 90.

Natural Order. Casuarineæ.

Synonyms. C. lugubris, Salisb. C. tenuissima, Sieber.

Alternative Names. She-Oak, Beef-wood, Koondeba in Queensland (5). Australian Mahogany, Botany Bay Oak in England. Gedraaid Beef-wood at the Cape of Good Hope (51). Noo Loi and River Oak in New South Wales (12). Mountain Oak (15).

Sources of Supply. Queensland, New South Wales and South Australia.

Physical Characters, etc. Recorded dry-weight 48½–53 lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell and taste none. Burns well: embers glow in still air. Solution with water or alcohol colourless.

Grain. Fine, dense and even. Surface bright: the rays and ground-tissue equally reflecting.

Bark. "Corky" (5).

Uses, etc. Cabinet-making: splits very easily with a clear fracture: a very beautiful furniture wood.

Authorities. Nördlinger (86), vol. iii. p. 42. Boulger (12). Ditto (15). Bailey (5), p. 133. Nilson (85), p. 42.

Usually confused with Red Oak and other Casuarinas.

Colour. Dark or brick red and light red in a striking network. Sap-wood light brown, sharply defined from the heart.

Anatomical Characters. Transverse section:—

Pores. Readily visible, medium, size 3: very variable, increasing in size as the tree ages, irrespective of the annual fluctuation: 30–55 per sq. mm.: dendritic: isolated pores occasionally appearing in the midst of a ray: groups of 1–4 loosely connected: often with white contents.

Rays. Of two sizes, the larger exceptionally prominent, very broad, size 1, widening outwards, very long, only limited by the bark, into which they project beyond the wood: often forking outwards: few, 12–17 per *inch*: light red in the heart, light brown in the sap: denser than the ground-tissue. The small rays are extremely fine and need microscope.

Rings. Not traceable.

Soft-tissue. In fine, weak, microscopic lines concentrically connecting the rays: size 3–4 (ray scale): a fine network with the fine rays: also encircling the pores.

Pith. Small, about 1 mm. in diameter, an elongated-oval in shape.

Radial Section. The ground is very much lighter and the rays

are very much darker, i.e. the converse of the transverse section. Pores, light coloured lines. Rays, exceptionally broad flakes. Rings imperceptible, as is also the soft-tissue, except as continuations and linings to the pores.

Tangential Section. As the Radial, but the larger rays are broad, spindle-shaped, red stripes, sometimes several inches high. Plate XXI. Fig. 173.

Type specimens authenticated by F. M. Bailey, and also from commercial sources.

No. 188. BIRCH. Betula alba. Linn.

PLATE XIV. FIG. 119.

Natural Order. Cupuliferæ.

Synonyms. B. lenta, Duroi. B. verrucosa, Ehrh. B. pendula, Roth., and many others of no interest here. The B. lenta, Linn., is the B. nigra, Duroi.

Alternative Names. Silver Birch, Black Birch (var. nigra). Russian Maple and Russian Birch (48).

Sources of Supply. Northern Europe, Asia and America.

Physical Characters, etc. Recorded dry-weight 32–48 lbs. per cu. ft. Hardness Grade 7, soft, compare Deal: the black variety rather harder. Smell and taste none. Burns well with long lively flame and little smoke. Solution colourless.

Grain. Very fine, close and even. Surface smooth with satiny lustre. "As though strewn with meal" (86).

Bark. Shining, laminated, peeling off in curling bands. Lenticels very large and laterally extended: white or silvery when young or purple-brown or black: deeply fissured and corky when old and at the butt. The transverse section shows numerous whitish, hard, ray-like bodies.

Uses, etc. Turnery, pit props, put-logs. "Ladders, sabots, hoops . . . shrinks 15–20% of its bulk when green . . . rapidly decays under exposure . . . Moderately durable" (69). Very perishable if young, especially when not scotched (i.e. scored through the bark). Sometimes fails to stand a voyage of a few weeks.

Authorities. Hartig (42), pp. 41, 32. Schwartz (106), p. 484, plate 2. Nördlinger (187), p. 513. Ditto (86), vol. iii. pp. 47–48. Royle in Holtzapffel (48). Mathieu (69). Wiesner (113), L. 12, p. 886.

Colour. White: yellowish-white: reddish white. A sapwood tree, no heart.

Anatomical Characters. Transverse section:—

Pores. Need lens, rather fine, size 4, somewhat variable in size: evenly distributed throughout the ring: branched: rather

numerous, 35–50 per sq. mm.: occasional groups of 2–8 pores: "in wide rings a net-work is sometimes discernible" (69).

Rays. Need lens, fine, size 5: nearly straight, but avoiding the pores a little: long: denser than the ground-tissue: rather numerous, 6–8 per mm.: rather irregularly spaced, a pore-width or more apart.

Rings. Fairly clear: boundary, a narrow brown line of Autumn wood, accompanied at times by a thin pore-ring: contour coarsely undulating.

Soft-tissue. "Intermingled with the fibres" (69). Scattered cells.

Flakes. An important feature: yellowish-brown or brown: numerous towards the centre of the tree, rarer in the older wood.

Pith. Small, about ½ mm. diameter: oblong or three-cornered: brownish.

Radial Section. Pores fine, inconspicuous scratches: rays need microscope: ring-boundaries rarely perceptible. Flakes long, narrow brown stripes to about 1·5 mm. wide.

Tangential Section. As the Radial, but the flakes appear as much wider lines to about 3 mm. wide, and the rays are minute, vertical, colourless lines needing considerable magnification.

Type specimens from trees known before felling.

No. 189. AMERICAN BIRCH. Betula lenta. Linn.

PLATE XIV. FIG. 120.

Natural Order. Cupuliferæ.

Synonyms. B. carpinifolia, Ehrh. B. excelsa, Hook. B. nigra, Duroi.

[NOTE.—The B. lenta, Duroi, is the B. alba, Linn.: that of Regel is B. carpinifolia, Griseb.]

Alternative Names. Black Birch, Cherry Birch, Mountain Mahogany (49). Mahogany Birch (100). Sweet Birch, Yellow Birch in Prince Edward's Isle: Dwarf Birch in Nova Scotia: River Birch and Mountain Birch in Canada (12). Hainbirke (131). Merisier (65).

Sources of Supply. Canada and the United States.

Physical Characters, etc. Recorded dry-weight 37½–48 lbs. per cu. ft. Hardness Grade 5, compare English Ash, Holly, Elm. Smell and taste none. Solution with water or alcohol colourless.

Grain. Fine, close and even. Surface smooth and of sparkling lustre, which is due to the ground and to the shining linings to the pores.

Bark. "Smooth, reddish-brown when young, scaling later in hard, woody scales" (49). Like that of English Birch.

Uses, etc. Cabinet-making and for very many other purposes.

It will not take nails as it splits too readily. " Good for turnery . . . compact, . . . easily worked, sometimes handsomely figured . . . not durable . . . ship-frames " (95).

Authorities. Nördlinger (86), vol. v. p. 44. Hough (11), pt. ii., p. 35. Wiesner (131), L. 1, p. 62. Macoun (65). Laslett (60), p. 182. Sargent (100), No. 299. C. Robb (95).

Sometimes confused with Beech or Maple.

Colour. Uniform reddish-brown heart-wood, well but not sharply defined from the 2–4 inches of yellowish-white sap-wood.

Anatomical Characters. Transverse section :—

Pores. Clearly visible without lens : medium, size 3, somewhat variable : evenly distributed, loosely branched : numerous, 40–70 per sq. mm. : groups of subdivided pores from 1–5 pores in radial or nest-like groups : white.

Rays. Need lens, fine, size 5 : nearly straight, slight undulations here and there : long, but often tapering to fine ends : uniform in breadth : denser than the ground : rather numerous, 4–5 per mm. : brown : a pore-width or more apart, irregularly spaced.

Rings. Fairly clear in the solid, less so in a transparent section: boundary, a fine, darker-brown line of Autumn wood, and often a loose ring or pores : contour well-rounded : colour uniform.

Soft-tissue. None, or merely occasional cells or strings.

Radial Section. Pores, fine scratches, sometimes shining : rays, minute brown lines or flakes readily visible or even noticeable, not lustrous : rings extremely fine but very clear, brown lines.

Tangential Section. As the Radial, but the rays are extremely fine lines, scarcely visible with lens, and the rings broaden a little in the loops, but still remain very thin.

Type specimens from commercial sources and also authenticated by Hough.

No. 190. ALDER. Alnus glutinosa. W.

PLATE XIV. FIG. 121.

Natural Order. Cupuliferæ.

Synonyms. Alnus communis, Desf. Betula Alnus, Linn. B. glutinosa, Lam.

Alternative Names. Black Alder, Common Alder. Aune commune : Vergne (69). Gemeine-, Schwartz-, or Roth-erle (86). Else : Eller (68).

Sources of Supply. Europe.

Physical Characters, etc. Recorded dry-weight 26–41½ lbs. per cu. ft. Hardness Grade 7, compare Birch. Splits easily. Smell none. Taste slightly astringent. Burns well in a current of air :

little smoke. "Deposits a kind of lustrous soot (Glanzruss)" (86). Embers readily die out.

Grain. Very fine, sinuous and even. Surface bright, not very smooth.

Bark. Smooth, black or greenish-brown when young, with sticky glands and large lenticels: later blackish-brown, scaling in large, flat flakes, separated by angular fissures: one layer.

Uses, etc. "Of extraordinary durability under water, otherwise subject to the attacks of beetle-larvae" (86). "Decays almost as soon as Beech or Birch, in alternate wet and dry . . . water pipes, well timber and pit props, sabots . . . very brittle, cracks and warps very much" (89). "Dense and very elastic" (68). "Perishable in the air, but its durability under water is at least equal to that of the Oak" (11). "Used for the piles of the Realto, Venice. Interior fittings, turnery, bobbins, common toys and foundry-patterns" (48). Usually met with in logs with bark as felled.

Authorities. Hartig (42), pp. 27, 41. Schwartz (106), p. 482. Nördlinger (87), p. 511. Ditto (86), vol. iii. p. 46. Mathieu (69), p. 421. Martin (68), p. 234. Boppe (11), p. 80. Mouillefert (79), p. 242. Holtzapffel (48), p. 71. Wiesner (131), L. 12, p. 885.

Colour. Brown, light red: white or greenish-orange when freshly felled. "Becomes lighter with age and dryness" (68). A sap-wood tree. "Heart not coloured when sound" (131).

Anatomical Characters. Transverse section:—

Pores. Need lens, fine, size 5, practically uniform: evenly distributed: numerous, 75–100 per sq. mm.: single or in radial groups of 2–6 or even 10: linear or branched (87). "Yellowish-red contents at times" (131).

Rays. Clearly visible in certain lights. Two sizes, the larger rather broad to broad, size 2–3, gently undulating, nearly straight, very long, few: the smaller very numerous, 5–8 per mm., a pore-width apart, and sometimes avoiding the pores.

Rings. Clear with lens, a line of contrast betwen the rather denser Autumn wood and the laxer Spring wood: contour convex outwards (crenate) between the larger rays: little difference in colour between the Autumn and Spring wood.

Soft-tissue. Isolated cells. "None" (86). "Scattered amongst the wood-fibres" (69).

Flecks. Frequent: brown. "Sometimes forming loose circles" (86).

Pith. "Small, 1–2 mm. diameter, three-sided or lobed" (86).

Radial Section. Pores, fine scratches without contrast of shade or colour. Large rays appear as occasional large flakes: the smaller numerous, obscure, narrow lines slightly darker than

the ground. Ring-boundaries extremely fine, inconspicuous lines. Flecks, long, narrow brown bands.

Tangential Section. As the Radial, but the larger rays appear as lines several inches high: the smaller about 0·5 mm. high.

Type specimens from commercial sources and also from trees known before felling.

No. 191. RED ALDER. Alnus rubra. Bong.

PLATE XIV. FIG. 121.

Natural Order. Cupuliferæ.

Synonym. A. glutinosa, Pursh.(not Willd.). A. oregona, Nutt,

Sources of Supply. United States and Canada.

Alternative Names. Western Alder (12). Alder (2). Oregon Alder (49).

Physical Characters, etc. Recorded dry-weight 30 lbs. per cu. ft. (No other details, as I have no solid specimen.)

Bark. "Thin, scarcely more than ¾ in. in thickness, smooth, excepting for very slight transverse ridges and excrescences, and is of a more or less mottled pale grey colour and often nearly white" (49).

Uses, etc. "A large tree" (12). "Much of it is under 2 ft. in diameter . . . runs up to a considerable height, very straight . . . furniture, inside finishing" (2). "Light, soft, not strong, brittle, very close-grained, compact and easily worked . . . furniture . . ." (100). "Wooden ware . . . dug-out canoes" (49).

Authorities. Macoun (65), p. 437. Anderson (2), p. 13. Sargent (100), p. 113. Hough (49), pt. ix, p. 40.

Colour. "Light brownish, nearly white" (2). "Light brown tinged with red. Sap-wood nearly white" (100). "Assumes a brownish tint upon exposure to the air" (49).

Rays. "Distinct, broad" (100).

No. 192. HORNBEAM. Carpinus Betulus. Linn.

PLATE XIV. FIG. 122.

Natural Order. Cupuliferæ.

Alternative Names. Yoke-elm (48). Weissbuche: Hainbuche: Hagebuche: Hornbaum (131). Hagbuche (81). Carpin: Charme in France: Carpy: Hardbeam: Quick-tree: Quickbeam: Quickenbeam (Glaser's Taschenwörterbuch). Charmelle (69).

Physical Characters, etc. Recorded dry-weight 45–56½ lbs. per cu. ft. Nördlinger quotes the specific gravity as 0·92–1·25. The latter figure is equal to 75·625 lb. per cu. ft. and must, I

feel sure, have been taken from an abnormally heavy piece of wood. Hardness Grade 4, compare Maple. Smell or taste none. Burns well and quietly with a lively flame: embers glow in still air. Solution faint brown slightly deepened by potash: ppt. brownish.

Bark. Brownish, about $\frac{1}{8}$ to $\frac{3}{16}$ inch thick, one layer, levelling up the intervals between the lobed exterior of the log, i.e. thinner and thicker alternately: hard, woody, smooth externally: contains a few hard, white bodies." Dull grey, greenish" (106). "Ashen grey, supple" (69). Plate XIX. Fig. 166.

Grain. Fine, dense and compact though open.

Surface. Bright.

Uses, etc. "Cogs, skittles, plumbers' dressers and mallets . . . tough and stringy." (48). "Difficult to split, strong and tough, not very durable" (131). "Stands exposure without being affected by it, . . . when subjected to a vertical pressure, cannot be destroyed: its fibres instead of breaking short double up like threads" (60). "Indispensable to the turner and cannot be replaced by any other wood for many purposes—screws, etc." (68).

Authorities. Holtzapffel (48), p. 87. Wiesner (131), p. 889. Nördlinger (87), p. 514. Ditto (86), vol. iii. p. 66. Laslett (60), p. 160. Schwartz (106), p. 479. Martin (68), p. 229. Mathieu (69), p. 396. Mouillefert (79), p. 139.

Colour. Greyish-white. A sap-wood tree.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 4: uniform: scattered: few 40–75 per sq. mm., in groups of 1–16. "Sometimes branched" (87), more usually in short, subdivided, radial groups.

Rays. Clear: two sizes, the larger size 1–2, seldom less than 0·5 mm. apart, and gracefully curved: compound, i.e. made up of the smaller rays in a continuous mass: "the broad rays are absent in the branches" (87): the smaller rays need lens, size 5–6 and 6–9 per mm.: rather more than a pore-width apart: both lighter in colour and denser than the ground-tissue.

Rings. Visible but not prominent: of lobed or undulating (crenate) contour: boundary a more prominent line of denser wood here and there and much clearer with the unaided eye than with the microscope.

Soft-tissue. Abundant in numerous, fine, undulating lines, following the contour of the rings as in the Oak: narrower than the small rays and slung between the larger like the rungs of a rope-ladder. No wood parenchyma according to Nördlinger (87).

Pith. Five-lobed, about 1 mm. diam.

Radial Section. Pores, just visible, minute colourless scratches.

Rays, readily visible narrow lines with an occasional broad white flake.

Tangential Section as the Radial, but the smaller rays appear as minute fine lines under the microscope and the larger are just visible to the unaided eye, though of considerable size: they lack contrast of colour.

The compound rays are built up into masses of considerable height. Many authors speak of them as "false rays," but "compound" is a much better term, as they are in no way adventitious. At the same time they differ from all ordinary large rays inasmuch as there is a slight projection where they meet the bark in the place of the usual invagination (tongue and groove). The lines of soft-tissue behave towards these rays in precisely the same way as in the Oak.

Type specimens from commercial sources and also from trees known before felling.

No. 193. HOP HORNBEAM. Ostrya virginica. Willd.

PLATE XIV. FIG. 123.

Natural Order. Cupuliferæ.

Synonyms. O. vulgaris, Wats. (not Willd.). O. americana, Michx. O. virginiana, C. Koch. Carpinus Ostrya, Linn. C. virginiana, Mill (not Michx.).

Alternative Names. Stone-wood in England. Iron-wood; Leverwood in U.S.A. (49).

Source of Supply. United States of America.

Physical Characters, etc. Recorded dry-weight, 47½–58 lbs. per cu. ft. Hardness Grade 4, compare Hornbeam. Smell or taste none. Burns well; no smell; embers glow brightly in still air. Solution the colour of the wood.

Grain very fine though open. Surface dull.

Bark. "A peculiar brownish-grey, checked into long, narrow oblique scales or strips loosely adhering to the trunk" (49). Thin, about ⅛ inch.

Uses, etc. "A valuable timber for axe-helves, tool-handles, levers, fence-posts, but not generally found of sufficient size to make it a very important timber of commerce" (49). About 30–50 ft. by 1–2 ft. diam. (very durable in contact with the soil" (100)

Authorities. Hough (49), pt. ii. p. 31. Robb (95). Sargent (100). Wiesner (131), L. 12, p. 890. No. 292. Nördlinger (86), No. 13, p. 66.

Colour. Pink or pinkish-white to brown. Sap-wood about 2 in., wide : white. Sharply defined from the heart.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 3–4, rare in the Autumn zone ; almost uniform in size ; 35–85 per sq. mm. ; often something approaching to a pore-zone ; single or in groups of from 2–17 pores, mostly one-rowed but some two-rowed groups ; in a radial or oftener a tree-like arrangement.

Rays. Need lens, size 5–7, uniform ; equidistant, the ends being a pore-width apart ; weak but running round the large pores only ; scarcely denser than the ground-tissue ; very many, 10–17 per mm. ; taper considerably ; brown.

Rings. Very clear in transparent section, less so in the solid but still definite. Boundary a *line* of Autumn wood.

Soft-tissue. A series of fine, concentric lines (micro.) in the Spring zone which break up in the Autumn zone wood to vague bars ; *also* encircling and imbedding the pores and joining them into a tree-like (dendritic) arrangement. White and clearly visible to good eyesight.

Pith.?

Flecks. Narrow oval flecks occasionally.

Radial Section. Much lighter in shade than the transverse section. Pores need lens: minute colourless lines: bright when empty. Rays minute, inconspicuous, dull, whitish flakes. Rings not prominent but still clear, brown lines.

Tangential Section. As the Radial, but the rays are just perceptible with lens (better with micro.), after moistening : brown, rather broad, spindle-shaped lines, about 0·3 mm. high. Soft-tissue not visible to the unaided eye.

Type specimens from commercial sources, also authenticated by Hough.

No. 194. HOP HORNBEAM. Ostrya carpinifolia Scop.

PLATE XIV. FIG. 123.

Natural Order. Cupuliferæ.

Synonyms. O. italica. Spach. O. vulgaris. Willd. (not Wats.). Carpinus italica. Scop.

Sources of Supply. Southern Europe, Asia Minor.

Alternative Names. Ostrya commun : Charme-houblon in France (69). Hopfenbuche and Schwartzbuche, in Germany (131).

Physical Characters, etc. Recorded dry-weight 57 to 58 lbs. per cu. ft. Hardness Grade 3, compare Common Hornbeam. Smell or taste none. Burns well with a quiet steady flame :

embers glow in still air : no smell or exudation with heat. Solution colourless.

Grain. Very fine, even, and dense though open : a compact, solid wood. Surface bright to dull.

Bark. 1 to 1½ inches thick, rich, deep brown : deeply fissured and scaling in long flakes which are seen to be clearly marked off in the inner layers in vertical section : closely adherent, corky but rather hard : many light-coloured sclerenchyma fibres.

Uses, etc. Similar to those of the Common Hornbeam, a valuable wood for turnery resembling Pear-tree wood. "Very tenacious" (69).

Authorities. Mathieu (69), p. 403. Wiesner (131), L. 13, p. 890.

Colour. Heart-wood light-red, pinkish to brown fading gradually into the lighter sap-wood.

Anatomical Characters. As those of O. virginica No. 193. Transverse section differs inasmuch as the tree-like arrangement is not so visible to good sight, the soft-tissue not being so white and therefore does not show up without considerable magnification.

Tangential Section. The same feature provides a slight distinction as S-T appears as clearly hoary fringes to the loops, readily visible to the unaided eye.

Type specimens from a tree grown in the Royal Gardens, Kew, sent to me by the kindness of Sir Wm. Th. Dyer.

No. 195. HAZEL. Corylus avellana. Linn.

PLATE XIV. FIG. 124.

Natural Order. Cupuliferæ.

Alternative Names. Nut-wood : Filbert : Noisetier. Coudrier noisetier (69).

Sources of Supply. Europe.

Physical Characters, etc. Recorded dry-weight 35-45 lbs. per cu. ft. Hardness Grade 7, compare Alder or Birch. Smell none. Taste faintly astringent. Burns well and quietly : embers glow in still air. Solution with water almost colourless.

Grain. Very fine and close. Surface bright.

Bark. About $\frac{1}{16}$ inch thick with a shiny, brown skin readily peeling off : grey when old : lenticels conspicuous. The rays are continued nearly through the bark which is plainly indented within.

Uses, etc. Barrel-hoops, ladder-rungs, turnery, charcoal for gunpowder . . . not durable, very elastic. Usually confused with Birch. Of small size.

Authorities. Nördlinger (87), p. 517. Ditto (86), vol. iii.

p. 68. Hartig (42), pp. 28, 41. Schwartz, p. 479. Westermeier, p. 59. Holtzapffel, p. 86. De Mornay (70), p. 98. Mathieu (69), p. 392. Wiesner (131), L. 12, p. 887.

Colour. White or reddish-white. A sap-wood tree. Heartwood only in old trees and then apparently caused by disease.

Anatomical Characters. Transverse section :—

Pores. Need lens, size 5–6, some variation, decreasing towards the outer side of the ring, in which they occupy less space : numerous, 160–180 per sq. mm. : many subdivided or in radial groups of as many as 12 : they are collected into a tree-like arrangement.

Rays. Clear, two sizes. The larger compound, size 2, broad, rarely less than 1 mm. apart : swelled apparently at the junction with the ring-boundaries : very long, tapering inwards only : tissue dense and lax alternately, as though fine rays were compacted into a large one by softer tissue : brown. Small rays very fine, dense and slightly avoiding the pores.

Rings. Very clear. Boundary, a line of contrast between the dense Autumn wood poor in pores and the porous Spring wood : contour convex outwards between the rays (crenate).

Soft-tissue. Not visible with lens : fine wavy concentric lines.

Flecks. Rare : brown : in the late Autumn wood.

Pith. Three-lobed : brown : 1–1½ mm. wide.

Radial Section. Pores needs lens : fine, isolated scratches except where a radial group is cut exposing several together. Rays, inconspicuous, almost without contrast with the ground. Rings appear as faint fine lines and the pith as a soft brown band.

Tangential Section. As the Radial, but the pores are much less prominent and the rays appear as lines of considerable height, about ½ inch : they can best be estimated immediately under the bark.

Type specimens from trees known before felling.

No. 196. OAK (European). Quercus Robur, var. sessiliflora, Sm. and var. pedunculata. Ehrh.

PLATE XIV. FIG. 125.

Natural Order. Cupuliferæ.

Alternative Names. Many, derived from the place of origin or port of shipment, such as Memel, Riga, Stettin, Danzig, etc. European White Oak in the U.S.A. (12). In France Q. pedunculata is called variously Chêne blanc (Gironde, Landes, Picardy) : Chêne à grappes, C. femelle, Gravelin : Chagne (in the South) : C. noir (Blasois). Q. sessiliflora is called Chêne

mâle, C. noir, Durelin, Rovre, Drille or Drillard (Compiègne) and C. blanc (Blasois and the South) (69). In Germany the former is called Stieleiche and Sommereiche: the latter Traubeneiche and Wintereiche.

Source of Supply. Europe generally.

Physical Characters, etc. Recorded dry-weight 35–53 lbs. per cu. ft. Hardness Grade 6, compare Walnut or Chestnut. Smell slight or none when dry. Taste astringent. Burns very well: embers glow dully in still air. Solution with water brownish.

Grain. Very coarse and open. Surface scarcely bright.

Bark. Of Q. pedunculata silvery, when young, often like dull tin-foil in patches, or lustrous-brown splashed with black: supple: deeply fissured when old, brownish, corky and scaling off in flakes. Of Q. sessiliflora hard, blackish or yellowish to brown, deeply fissured when thick.

Uses, etc. Ship-building and all purposes where strength, rigidity and durability are needed. All other European woods are mere substitutes (69). Cannot be used in contact with iron as it quickly sets up corrosion.

Authorities. Mathieu (69), pp. 345, 353. Nördlinger (87), p. 535. Ditto (86), vol. iii, p. 80. Schwartz (106), p. 478. Laslett (60), pp. 92, 124, 127. Boppe (11), p. 56. Ward (124), p. 136 (much information). Westermeier (129), pp. 24, 26. Holtzapffel (48), p. 95. Hartig (42). Stevenson (113). Wiesner (131).

Colour. Heart-wood brown, well defined from the light-brown sap-wood, which is from 9–35 rings wide (69).

Anatomical Characters. Transverse section:—

Pores. Conspicuous, size 1, coarse, much regular variation, diminishing in size to the outer side of the ring. The large pores in a prominent pore-ring 1–4 rows deep, crowded. Small pores arranged in a tree-like manner, or in radial or branched lines or in club-like masses compacted by soft-tissue and even widening to rejoin adjacent masses. Very numerous in the autumn wood. Usually contain thyloses.

Rays. Conspicuous: of two sizes. The larger, size 2, broad, long, rarely less than 1 mm. apart: apparently swelling at their junction with the ring-boundaries: tapering both ways eventually, brown: dense. The small rays very fine, size 6, need lens: avoid the pores slightly: many between each of the larger rays.

Rings. Very prominent. Boundary, the conspicuous, boldly-contrasted pore-ring against the small-pored, dense Autumn zone: contour undulating.

Soft-tissue. Imbedding and compacting the pores into the radial or tree-like groups: also in concentric lines about

size 2 (ray-scale) and about 0·5 mm. apart, undulating and following the contour of the rings.

Pith. White or brownish, about 1-4 mm. thick, five-lobed.

Radial Section. Pores, coarse grooves with chambers readily visible to the naked eye, shining when empty but often filled with thyloses. Rays, broad, bright (though not lustrous), conspicuous and beautiful plates. Ring-boundaries not continuously traceable but the bands of coarse pores clearly divide each ring. (See Frontispiece.)

Tangential Section. As the Radial, but the pores appear distinctly finer as they are exposed in the direction of their shorter diam.: rays inconspicuous (though large), darker-brown, narrow, spindle-shaped lines sometimes as much as 2½ inches high. The smaller rays need lens and are composed of a single row of cells. These cells are larger than those of which the large rays are composed. (See Frontispiece.)

Type specimens from trees known before felling.

No. 197. AMERICAN RED OAK. Quercus rubra. Linn.

PLATE XIV. FIG. 125.

Natural Order. Cupuliferæ.

Alternative Names. Canadian Red Oak. Black Oak (53).

Source of Supply. North America: Canada and the United States. Naturalized in Europe.

Physical Characters, etc. Recorded dry-weight 40 to 49¼ lbs. per cu. ft.

Bark. "Remains supple for a long time, 60 to 70 years, but becomes fissured and scaly at length" (51).

Uses, etc. "Not so desirable as the European species, little appreciated in America, and Michaux has given it a bad reputation (69) in Europe. It is valuable for fuel, clap-boards and furniture." "Light, spongy, not very durable" (95). "Unfit for architecture and engineering works requiring strength and durability"(60). "Does not check in drying, . . . rarely exceeding 2 ft. in diam." (53). Boulger says "unfit for staves of liquor casks," while Wiesner on the contrary states that the wood is "favoured for the manufacture of cask-staves."

Authorities. Wiesner (131), L. 6, p. 64. Boulger (15), p. 26. Mathieu (69), 370. Nördlinger (87). Robb (95). Laslett (60), p. 173. Sargent (100), No. 273.

Colour. Reddish-brown heart-wood, very sharply defined from the nearly white sap-wood.

Anatomical Characters. As Quercus Robur, but the rays in Tangential section are very pale and inconspicuous and rarely

more than ½ inch high and proportionately narrow. In Radial section they are silvery like white satin, very brilliant and beautiful. The pores are filled with reddish contents (thyloses) which are much deeper in colour than the rest of the wood. In transverse section the rays scarcely increase at all in width as they proceed outwards towards the bark.

I have no solid specimen that I can call authentic, the above details being taken from Hough's section No. 15.

No. 198. AMERICAN WHITE OAK. Quercus alba. Linn.

PLATE XIV. FIG. 125.

Natural Order. Cupuliferæ.

Alternative Names. Baltimore Oak (60). The popular name of " White Oak " is widely applied to many other species.

Sources of Supply. North America, Canada and the United States.

Physical Characters, etc. Recorded dry-weight 43½–65⅞ lbs. per cu. ft. Boulger (15) gives the figures " 1.054 to 695 " as the specific gravity and " 46·35 " for the weight per cu. ft., thus implying that the former may vary while the latter is constant.

Bark. " Whitish-grey " (49).

Uses, etc. "Perfectly straight timber may be had from 25–40 ft. long by 11–20 in. square . . . the wood is less hard and horny than the White Oak (see note), and when thoroughly dry is scarcely so strong as Fir or Pine. Inferior to Q. robur " (60). Laslett deals with Q. alba under two quite different heads, viz. " White Oak " and " Baltimore Oak," and ascribes different properties to each notwithstanding that he includes them in the same species.

Authorities. Laslett (60), pp. 167, 172. Kew Guide (57), p. 45. Hough (49), part ii. p. 28. Boulger (15), p. 262.

Colour. Heart-wood, brownish or reddish-brown, sharply defined from the nearly white sap-wood.

Anatomical Characters. As those of Quercus Robur, No. 196, from which it is difficult to distinguish. As I possess no properly authenticated specimen, I have used Hough's section to arrive at the above facts. The rays in radial section are dull except when viewed in one direction.

No. 199. WESTERN WHITE OAK. Quercus Garryana. Dougl.

PLATE XIV. FIG. 125.

Natural Order. Cupuliferæ.

Synonym. Q. Jacobi, R. Br.

Alternative Names. Western Oak (2), Oregon Oak, Mountain White Oak (49), White Oak (100).

Sources of Supply. North America and Canada. In British Columbia it is practically confined to Vancouver.

Physical Characters, etc. Recorded dry-weight, 46½ lbs. per cu. ft. I possess no other details, having no solid specimen.

Grain. Compact, straight, coarse in radial section, moderately so in tangential section. Surface dull, except that of the rays in one direction of the light.

Bark. " Light grey with rather narrow, scaly ridges " (49).

Grain. Compact.

Uses, etc. " Furniture and cabinet-work . . . logs 3–4 ft. in diameter by 10–20 ft. long are not uncommon " (65). " Not much used on account of the difficulty in seasoning it properly " (2). " Strong, tough and compact. One of the most valuable Oaks of the Western Coast, being that which the White Oak (Q. alba) is in the East, and is applied to the same uses " (49). " Wood strong . . . that of the young trees tough . . . carriage and cooperage stock, shipbuilding . . . the best substitute for the Eastern White Oak, produced in the Pacific Forest " (100).

Authorities. Macoun (65), p. 27. Hough (49), pt. vii. p. 37. Anderson (2), p. 14. Sargent (100), p. 138.

Colour. " Light brown or yellow : the sap-wood lighter, often nearly white " (100).

Anatomical Characters. As those of Q. Robur, rubra and alba, No. 196 *et seq.*

Rays. In tangential section narrow and short, about 0·5 mm. wide by 2 cm. (say an inch) long : blunt and linear, not spindle-shaped.

These details have been taken from as a section by Hough.

No. 200. SPANISH OAK. Quercus oblongifolia. Torr.

PLATE XIV. FIG. 126.

Natural Order. Cupuliferæ.

Synonyms. Q. undulata, var. oblongata, Engel.

Alternative Names. White Oak (100).

Sources of Supply. America, California, New Mexico (100).

Physical Characters, etc. Recorded dry-weight 54½–62 lbs. per cu. ft. Hardness Grade 4, compare Hornbeam. Smell none. Taste strongly astringent. Burns very well, heat expels a brown juice, embers glow in still air. Solution with water faint brown.

Grain. Very fine, close and dense. Surface scarcely bright. Pores shining but inconspicuous. Rays dull.

SPANISH OAK

Bark. ?

Uses, etc. Shuttle-making, turnery. A wood of great solidity and pretty figure in every section. A tree growing to a height of 50 ft. with a diameter of 24 inches (49). "Generally hollow and defective when large: checks badly in drying . . . little value except for fuel" (100). (This does not apply to the sap-wood.) Usually met with in England in the form of shuttle blocks.

Authorities. Sargent (100), No. 263. Kew Museum, No. 1.

Colour. White: whitish-brown to brown striped with dark lines. "Very dark brown, almost black. . . . thick sap-wood" (100). See note.

Anatomical Characters. Transverse section:—

Pores. Need lens, size 2: diminish gradually and regularly to the Autumn boundary: usually one large isolated pore commencing the tree-like radial group: never crowded: no continuous pore-ring: few, 4–13 per mm.: no abrupt separation between large and small pores.

Rays. Conspicuous, two sizes (not compound). The larger size, broad, size 2: rarely less than 1 mm. apart: dilating at the ring-boundaries: very long: tapering both ends: tissue lax: light brown. Small rays very fine, size 7: numerous, 16–24 per mm.: avoid the pores: need lens.

Rings. Inconspicuous: the boundary a line of contrast between the lax, large-pored spring wood and the dense, small-pored Autumn wood: contour undulating, coarsely crenate (convex outwards).

Soft-tissue. Abundant in broad radial patches or strips enclosing the whole pore system: also fine, continuous waved lines in the late Autumn wood, faintly visible in the solid only and in well developed rings: follows their contour.

Pith. ?

Radial Section. Pores need lens: a few fine, shining, colourless lines. Rays bold, dull flakes: when brown darker than the ground. Rings not traceable. Soft-tissue just visible as hoary stripes or lines.

Tangential Section. As the Radial, but very different in appearance, the rays appearing a bold, conspicuous, spindle-shaped stripes, much darker than the ground, especially when brown: about 2 inches high by 0·5 mm. broad.

Type specimens from commercial sources checked by specimens in Museum No. 1, Kew. The apparent discrepancy between this description and that of Sargent (100) may be explained upon the assumption that the wood imported into this country is second-growth wood or perhaps sap-wood of large trees. On the other hand this species has much resemblance to Hough's section of Q. virens (49), pt. v. p. 43.

No. 201. CHESTNUT. Castanea sativa. Gaertn.

PLATE XV. FIG. 127.

Natural Order. Cupuliferae.

Synonyms. C. vesca. Gaertn. C. vulgaris, Lam.

Sources of Supply. Europe, North America.

Alternative Names. Sweet, Spanish, or Edible Chestnut. American Chestnut in the U.S.A. (121). Europeesche or Kaapsche Kastanje in South Africa (51).

Physical Characters, etc. Recorded dry-weight 32–46½ lbs. per cu ft. Hardness Grade 6, firm: compare Oak. Smell none. *Taste astringent and unpleasant.* Burns well, but the embers expire in still air and leave the carbonized wood. Solution colourless.

Grain. Coarse and open. Surface somewhat lustrous, but the rays and pores dull

Bark. Smooth, dull, dark brown, about the thickness of an annual ring when young: lenticels small and round. When old, thicker, fissured, usually in a spiral or latticed form.

Uses, etc. [illegible] large logs quite sound [illegible] durable only in favourable [illegible] and dry. [illegible] a useful coopers' wood [illegible] ladders, hoops" [illegible] "Elastic [illegible], the young wood [illegible] durable [illegible] a post has been known to last eighty years in the ground [illegible] without [illegible] ing-point" (65). [illegible] refer [illegible] C. vulgaris [illegible] which is re[illegible] durable [illegible] splits rather easily [illegible]

Authorities. Hartig (42) [illegible] Schwartz (106), p. 483. Nördlinger (87), p. 515. [illegible] vol. iii. p. 70. Mathieu (69), p. 325. C. Robb [illegible] Gamble (37), p. 370. Wiesner (131), L. 12 p. 890.

Colour. Heart-wood, light to dark brown, well defined from the white sap-wood, which is about 2–6 rings wide.

Anatomical Characters. Transverse section :—

Pores. Prominent size 2, very variable: coarse, 1 or few-rowed pore-ring, succeeded by much smaller pores arranged in branched, radial lines (i.e. dendritically), all readily visible to the unaided eye: not many, 3–12 per sq. mm. in the pore-ring: 20–55 per sq. mm. in the later wood: large pores, oval, to 0·5 by 0·3 mm. diam.

Rays. Need lens, very fine, size 7, *one size only*: *difficult to see*, especially in transparent section: scarcely denser than the ground-tissue: long: very numerous, 8–10 per mm.: direct but avoiding the large pores.

Rings. Very distinct on account of the prominent pore-ring

and a line of contrast between the dense Autumn tissue and that of the spongy Spring wood.

Soft-tissue. Encircling and imbedding the pores and usually joining them into tree-like masses : also in concentric bands ?

Pith. Small, about 1·0 mm. diameter : somewhat 5-sided.

Radial Section. Pores very prominent as coarse, cellular grooves, often exposed for the length of several inches. Rays *inconspicuous* pale flakes. Rings not marked except by the pore-lines.

Tangential Section. As the Radial, but the pores are not so coarse as in the Radial section, but more of them are exposed side by side. Rays inconspicuous lines about 0·5 mm. high.

Type specimens from commercial sources and from trees known before felling.

No. 202. BEECH. Fagus sylvatica. Linn.

PLATE XV. FIG. 128.

Natural Order. Cupuliferæ.

The F. sylvatica of Walter is the F. ferruginea of Aiton.

Alternative Names. White Beech in Canada, New Brunswick and United States of America (12). St. John's Beech : American Beech in England when coming from St. John's, Newfoundland. Fau : Fayard : Foyard in France (69). Hangebuche : Mastbuche : Rothbuche in Germany.

Sources of Supply. Europe, Asia Minor and America in the colder temperate parts.

Physical Characters, etc. Recorded dry-weight 41–56 lbs. per cu. ft. Hardness Grade 6, compare Chestnut or Walnut. Smell or taste none. Burns very well with a lively flame without crackling or ejecting sparks: little smoke: embers glow in still air. Solution with water colourless.

Grain. Very fine and close. Surface bright.

Bark. Smooth without fissures until extremely old : green to greyish-brown when young, later silvery-grey : ¼ inch thick : leathery.

Uses, etc. " Lacks elasticity : twists : cracks easily : subject to the attacks of worms, . . . does not polish well : takes an antiseptic injection readily and is used for sleepers " (69). Liable to warp when drying : changes to a redder colour when steamed soon after felling when the sap is still in. Chair-making, charcoal, turnery, piles, plane stocks, sabots, butchers' blocks, felloes. Durable under water and under cover, but rapidly perishes when exposed to the weather. Crinon mentions a piece which had become as hard as stone after being buried for twenty-four years.

Authorities. Nördlinger (87), p. 519. Ditto (86), vol. i. p. 51.

Westermeier (129), p. 24. Boppe (11), p. 67. Hartig (42). Schwartz (106), p. 479, pl. 1. De Mornay (70), p. 48. Laslett (60), p. 149. Holtzapffel (48), p. 73. Stevenson (113), p. 41. Mathieu (69), p. 314. Petsche (92), p. 117. Wiesner (130 and 131).

Usually confused with Fagus ferruginea, Maple or Sycamore.

Colour. Reddish-white. A sap-wood tree. "Heart-wood in extremely old trees : only becomes reddish on exposure" (69).

Anatomical Characters. Transverse section :—

Pores. Need lens, size 5, fine, varying somewhat, decreasing gradually to the Autumn wood : uniformly scattered, rather more numerous in the Spring wood : numerous, 60-130 per sq. mm. : single or in groups of 2-5.

Rays. Prominent, size 2-3, very variable and irregularly spaced : the larger rarely less than 1 mm. apart and sometimes as much as 3 : quite straight : short, bold, shining : abruptly tapering both ends, the thin ends continuing indefinitely : the thin ends 12-15 per mm., avoiding the pores in the Spring pore-ring : brown : swelled at the junction with the ring-boundaries : denser than the ground-tissue. Wiesner (130) says there are three kinds of rays in this wood, but they are all the same except as regards the number of rows of cells, which are not constant, and vary in different portions of the same ray.

Rings. Clear, the boundary a line of contrast : contour convex between the thicker rays.

Soft-tissue. A few isolated cells here and there.

Pith. Reddish : three to five-cornered : about 1 mm. thick : hard.

Radial Section. Pores need lens : minute shining lines. Rays prominent, bright yellowish or reddish flakes. Rings faint, but sharp lines of contrast.

Tangential Section. As the Radial, but the rays appear as small brown, spindle-shaped lines to about 5 mm. high, prominent through their numbers and darker colour : their outer ends project into the bark. The rings are merely vague zones.

Type specimens from commercial sources and from trees known before felling.

No. 203. RED BIRCH. (New Zealand) Fagus fusca. Hook.

PLATE XV. FIG. 129.

Natural Order. Cupuliferæ.

Alternative Names. Tooth-leaved Beech : Tawhai raunui (91). Towai (111). Birch (A.G.). Hutu Tawhai (12).

Source of Supply. New Zealand only.

Synonyms. Populus canadensis. Mich. (not Fouger., nor Moench.). P. deltoidea, Marsh.

Alternative Names. Lace-wood (I. and S.). Peuplier Suisse : Peuplier de Virginie : Peuplier monilifère (8). Big Cottonwood : Necklace Poplar : Carolina Poplar (100). Poplar (95). Katoenhout (51). Wollpappel (131).

Source of Supply. North America. Canada and the United States.

Physical Characters, etc. Recorded dry-weight 24-34½ lbs. per cu. ft. Hardness Grade 7, compare Deal. Smell or taste none. Burns well without aroma : embers glow in still air. Solution very faint brown.

Grain. Very fine, open. Surface of the ground-tissue lustrous and silky : the pores shining, the rays dull.

Bark. Very thick, dark chocolate-brown with conspicuous and curious marking where the scales are commencing to separate in the inner part of the bark.

Uses, etc. Carpentry. "Not strong, compact, liable to warp in drying . . . ship-building, paper-pulp, light packing-cases, fence-boards, fuel . . . about 80-100 ft. high by 40-80 inches in diam." (100). "Carving . . . durable in dry places . . . does not readily take fire . . . soft, light, easy to work . . . wooden polishing-wheels" (95).

Authorities. Mathieu (69), p. 406. Sargent (100), No. 324. C. Robb. (95). Hutchins (51). Macoun (66), p. 457. Wiesner (131), L. 6, p. 61. Irvin and Sellers (I. and S.).

Difficult to distinguish from other Poplars when once cut up, and easily confounded with Canary Whitewood and other white woods.

Colour. White : yellowish-white : brownish-white : in light and dark bands : "slightly reddish" (69). Often silvery-white in longitudinal section.

Anatomical Characters. Transverse section. Compare No. 207.

Pores. On the limit of vision, size 2-3, little variation, smaller in the Autumn zone in wide rings but not diminishing in narrow rings, uniformly scattered with a tendency to loose, wavy, straggling lines : very numerous, 50-75 per sq. mm. : mostly pairs but also subdivided, radial groups (of as many as 10 in the outer part of the ring) which sometimes extend into the following year's ring.

Rays. Just visible, size 5-6, uniform : equidistant, about the width of a large pore apart : very weak : bad to count : avoid the large pores : denser than the ground-tissue : numerous 7-8 per mm.

Rings. Very clear : boundary the dense Autumn zone ad-

Physical Characters, etc. Recorded dry-weight 53¼ lbs. per cu. ft. Hardness Grade 5, compare English Elm. Tasteless. Smell faint. Burns well and quietly without specific aroma: embers glow dully in still air. Solution faint brown, turning slightly darker but not reddish upon the addition of potash, but a red ppt. is thrown down.

Bark. Dark brown, hard, ½–1 inch thick, fissured externally and separating in rough, rugged scales, which are speckled with white where broken and filled with long, hard, white bodies: closely adherent to the wood. In appearance of two layers, but the structure is really uniform throughout.

Uses, etc. Works more easily than English Beech. "A large timber tree, . . . often in vast abundance, . . . superior to all other kinds of Beech in general utility and undoubted durability, . . . a tree growing to 100 ft. high by 10 or more in diameter, . . . can be readily split through a block 70 ft long without the slightest waste, . . . of great strength and toughness, . . . much valued for railway-sleepers, piles, bridges and constructional works of every kind, . . . fences are known which are still serviceable after 40 years' use" (91).

Authorities. Perceval (91), pp. 11, 52 and 67. Smith (111), p. 417. Boulger (12), p. 479. Agent-General of N.Z. (A.G.).

Colour. Heart-wood brown, sometimes rather dark: well defined from the 1½–3 inches of rather lighter sap-wood.

Anatomical Characters. As Fagus sylvestris (No. 202), with the following differences:—

Pores. Very much larger, yet need lens: size 3–4: equally numerous and crowded: 40–80 per sq. mm.

Small Rays. Need lens: never prominent in any section, yet thickening a little in the middle: 9–11 per mm.: size 4. Large rays, rare, 1 or less per inch.

Rings. Well defined but not prominent.

Type specimen authenticated by the Forest Officer to the Government of New Zealand. This wood may be confused with Fagus Solandri, but is easily distinguished by the absence of the powerful smell and taste of that species.

No. 204. NEW ZEALAND BEECH. Fagus Solandri. Hook., fil.

PLATE XV. FIG. 129.

Natural Order. Cupuliferæ.

Alternative Names. New Zealand Birch: Towhai (A.G.). Towai (111). Tawhai rauriki: Entire-leaved Beech (91). White Birch in Nelson, Black Birch in Wellington (57). The native names are also applied to other species of Beech.

Physical Characters, etc. Recorded dry-weight about 47½ lbs. per cu. ft. Hardness Grade 6, compare English Beech. Smell unpleasant, and when worked, strong and unspeakably disgusting (? when dry). Taste as might be expected from the smell. Solution with water faint brownish, deepening to reddish-brown upon the addition of potash. Burns well and quietly with characteristic aroma: embers glow in still air.

Bark. "Black and rough" (24). Greyish-reddish-brown, ¼–½ inch thick: fissured by small cracks: filled with narrow, white, rod-like bodies.

Uses, etc. "A durable, hard, fencing and pile wood, but not fit for marine work" (60). "Used at present for firewood only" (59). "A tree 100 ft. by 4–5 ft. diameter, . . . bridges in fresh water, very durable, . . . suffers from the teredo" (57). "The most plentiful of all the woods of Southern New Zealand, . . . tough, . . . ship-building, . . . not much used so far, . . . splits easily into shingles, laths, etc." (24).

Authorities. Laslett (60), p. 311. Smith (161), p. 417. Perceval (91), p. 11. Kirk (59). Kew Guide (57), p. 75. Collinson (24).

Colour. Heart-wood, brown, uniform, though often streaky: as dark as English Beech after steaming: possibly a sap-wood tree.

Anatomical Characters. As those of Fagus sylvatica, No. 202, but with the following differences:—

Pores. Rather smaller and less numerous: single, or in groups of 2–3 between the smaller rays: size 4: 40–80 per sq. mm.

Rays. Need lens, size 5–6, fine: never large enough to be visible to the naked eye: too thin to speak of a thickening in the middle: very inconspicuous in all sections: not bright: to ⅛ inch high: 9–12 *per mm.*

Rings. Well defined but not prominent.

Type specimen authenticated by the Forest Officer to the Government of New Zealand. May be confused with F. fusca.

No. 205. RED BEECH. Fagus ferruginea. Ait.

PLATE XV. FIG. 128.

Natural Order. Cupuliferæ.

Synonyms. F. sylvatica, Walt. F. sylvestris, Michx.

Alternative Names. American Beech in the United States (49).

Sources of Supply. Canada, Nova Scotia, New Brunswick and the United States.

Physical Characters, etc. Recorded dry-weight 41–43 lbs. per cu. ft. In all other respects the same as the European Beech.

Bark. Similar to that of the common Beech: smooth not fissured.

Uses, etc. "Piles, wet foundations, planes, cogs, printing (block letters), . . . subject to the attacks of worms" (95). "Inclined to check in drying: difficult to season, . . . chairs, shoe-lasts, handles, fuel" (100). "A tree attaining the height of 100 ft. by 48 inches diameter, usually much smaller, . . . wood tough, close-grained: takes a beautiful polish, . . . used for ships' timbers to some extent" (49).

Authorities. Robb (95). Sargent (100). No. 291. Hough (49), pt. i. p. 63. Macoun (66), vol. iii. p. 444.

Colour. "Dark red, but often light: sap-wood, nearly white" (100). Almost indistinguishable from the European Beech, F. sylvatica, No. 202. Perhaps the greater fineness of the fibres of the ground-tissue in tangential section (? constant) and the tenuity of the ends and the comparatively wide intervals between the thickest portions of the rays may serve as slight distinctions. The rays are also very long and the silver-grain is broad and pink in colour.

Type specimen authenticated by Hough.

No. 206. WILLOW. Salix caprea. Linn.

PLATE XV. FIG. 130.

Natural Order. Salicineæ.

Synonym. S. cinerea, Linn.

Alternative Names. Common Sallow: Sally: Goat-willow: Grey willow. Saule marceau (70): Marsault: Marsaule (69) in France. Sahlweide (113).

Sources of Supply. Europe generally.

Physical Characters, etc. Recorded dry-weight 27–39 lbs. per cu. ft. Hardness Grade 7, compare Deal. Smell and taste none. Burns indifferently, needs draught, crackles noisily: embers glow in still air and consume very rapidly. Solution colourless.

Grain. Very fine and open. Surface lustrous.

Bark. Brown, rather shiny: later deeply fissured and corky.

Uses, etc. Cricket-bats, soles of carts, hoops, hop-poles. In France for ladders, sabots, carving, Esparto (69) chip-boxes: splits very easily and cleanly: does not splinter when bruised: fairly durable when exposed to the weather.

Authorities. Nördlinger (87), p. 539. Ditto (86), vol. iii. p. 61. Schwartz, p. 486. Hartig (42). Mathieu (69), p. 463–6. Westermeier (129), p. 30. Du Mornay (70), p. 97. Boppe (11), p. 83. Weisner (113), L. 12, p. 881.

Seldom confused with other woods on account of its distinctive colour.

Colour. Heart-wood brownish : brownish-yellow : rosy-white. "Vinous red at length" (69). Fades gradually into the yellowish, reddish, or white sap-wood.

Anatomical Characters. Transverse section :—

Pores. Scarcely visible, rather fine, size 4, gradually diminishing to the Autumn zone : uniformly scattered in concentric, wavy-straggling lines : very numerous, 150–250 per sq. mm. : single or in radial groups of as many as 7 in the late Autumn wood.

Rays. Just visible, very fine, size 6, uniform : equidistant, about the width of a large pore apart, nearly straight, avoiding the larger pores only : denser and of lighter colour than the ground-tissue : very numerous, 10–13 per mm.

Rings. Very clear : boundary, a line of contrast between the dense, small-pored Autumn wood and the spongy, large-pored Spring wood. Contour undulating here and there.

Soft-tissue. Lines of single cells without order.

Flecks. Usually very numerous, but not invariably present : mostly brown and plano-convex in section, with a bluish centre, 1–2 mm. wide.

Pith. Variable in size, usually 2–5 mm. wide : white : later yellowish or brownish.

Radial Section. Lighter in shade than the Transverse section. Pores readily visible though extremely fine : generally empty and shining. Rays just visible as minute marks of slightly darker colour than the ground. Rings very faint, narrow, brownish bands. Flecks narrow, brown lines to ½ mm. wide.

Tangential Section. As the radial, but the pores are not so crowded. Rays invisible without microscope. In the rings, the brown wood shows up much more prominently and the flecks appear as broad, brown lines up to 2 mm. wide.

Type specimens from commercial sources and from trees known before felling, checked by Nördlinger's section. The structure, apart from the physical characters and colour, is insufficient to distinguish one species of Salix from another, or indeed from Populus, Wiesner to the contrary notwithstanding.

No. 207. BLACK POPLAR. Populus nigra. Linn.

PLATE XV. FIG. 130.

Natural Order. Salicineæ.

Alternative Names. Peuplier franc : Léard : Liardier : Bouillard in Central France (8).

Sources of Supply. Europe.

Physical Characters, etc. Recorded dry-weight 25–36½ lbs. per cu. ft. Hardness Grade 8, compare White Pine or Lime-tree. Smell or taste none. Burns very well : consumes rapidly : embers

glow in still air. "Burns badly, and needs much draught" (87).

Grain. Extremely fine though open. Surface lustrous.

Bark. Blackish, deeply fissured, persistent.

Uses, etc. "Carving, carpentry, paper-pulp, railway break-blocks, clogs, packing-cases, etc. . . . not durable" (113).

Authorities. Nördlinger (87), p. 530. Ditto (86), vol. iii. p. 57. Westermeier (129), p. 38. Du Mornay (70), p. 85. Stevenson (113), p. 92. Laslett (60), p. 165. Schwartz (106), p. 486. Boulger (12). Wiesner (113), L. 12, p. 882. Mathieu (69), p. 492.

This wood is frequently confused with other species of Poplar, with Cotton-wood, Canary White-wood and other light soft woods.

Colour. Whitish: light brown: brownish-grey heart-wood with whitish or yellowish-white sap-wood, which is from 8–20 rings wide. "Veined with black in the heart" (69).

Anatomical Characters. Transverse section :—

Pores. Need lens, rather fine, size 4, varying considerably: uniformly scattered but branched in wide rings or arranged in loose festoons: numerous, 75–90 per sq. mm.: single or in subdivided radial groups of 2–8: oval: empty.

Rays. Just visible, very fine, size 6, uniform: equidistant, about the width of a large pore apart: nearly straight, running round the larger pores at times: denser than the ground-tissue: very numerous, 10–13 per mm.: almost the same colour as the ground.

Rings. Distinct, though not prominent: boundary, a clear, fine line of Autumn wood: contour regular.

Soft-tissue. Single cells or irregular areas apparently the bulk of the tissue.

Pith. About 1 mm. wide, five-sided to round: greenish-white (green in the angles).

Radial Section. Pores fine, shining, empty lines, with chambers longer than the width of the groove. Rays just visible in certain lights: fine, colourless, shining flakes. Ring-boundaries very fine lines, scarcely traceable.

Tangential Section. As the Radial, but the rays are invisible unless when stained, fine lines about 0·5 mm. high, and the ring-boundaries are readily traceable, distinct, fine lines.

Type specimens from commercial sources and also from trees known before felling.

No. 208. COTTONWOOD. Probably **Populus monilifera. Ait.**

PLATE XV. AS FIG. 130.

Natural Order. Salicineæ.

joining the coarse-pored Spring wood : contour gently undulating : of light and dark bands.

Soft tissue. In lines of single cells here and there : abundant.

Pith.?

Radial Section. Much lighter than the Transverse section. Pores just visible as brightly shining, empty grooves. Rays just visible, minute, dull flakes having scarcely any contrast with the ground.

Tangential Section. As the Radial, but the rays need microscope about 0·75 mm. high, of one row of cells.

Type specimens not authenticated but reputed to be this species.

No. 209. COCOBOLA WOOD. Species unknown.

PLATE XV. FIG. 131.

Physical Characters, etc. Recorded dry-weight 75 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell or taste none. Burns unusually well with a smell recalling sealing-wax : heat expels a crimson juice : embers glow in still air. Solution amber or brownish.

Grain. Coarse but close and even. Surface bright, the pores shining like jet when filled with resin, otherwise dull.

Bark.?

Uses, etc. Turnery, inlaying, Tunbridge-ware. The showiest and most strikingly-coloured of all our commercial woods. It usually comes to hand in the form of small, badly-hewn logs.

Authority. Wiesner (131), L. 12, p. 911.

Colour. Heart-wood deep orange or orange-red streaked with sharply marked jet-black lines. Sap-wood brownish-white sharply defined from the heart.

Anatomical Characters. Transverse section :—

Pores. Conspicuous on account of their jewel-like glistening. Size 1 to 2, rather coarse, little variation : fairly evenly and widely scattered : single or in compact groups of 2 or 3 : very few, from 0-4 per sq. mm., rarely as many as 7 : always filled with amber, ruby or black resin. (A gorgeous object under the microscope.)

Rays. Need lens, size 5 to 6, uniform : equidistant, crowded : very numerous, 9 to 11 per mm. : rarely tapering : denser and lighter in colour than the ground-tissue : not avoiding the pores but interrupted by them.

Rings. Doubtful, but there are fine, concentric lines broader than the rays that may indicate the boundaries.

Soft-tissue. In concentric lines as above, size 5, clearly visible

The arrangement of the pores seems to be between very-loosely-oblique or festooned lines or a combination of the two.

Rays. Just visible, size 5 to 6, uniform : equidistant, much less than a pore-width apart : avoiding the pores (even the second ray from a pore follows its contour): numerous, 10-15 per mm. : much laxer than the ground-tissue : composed of elongated, rectangular cells, very coarse : appear hoary.

Rings. Obscure : not traceable in any way.

Ground-tissue. Some of the cells contain gum.

Soft-tissue. None or scattered single cells.

Radial Section. Slightly lighter in shade than the Transverse section : pores very prominent, orange-coloured, shining grooves : lustre due to the linings : undulating : contain a few globules of golden gum. Rays, just visible, dull, inconspicuous, hoary lines. Rings not traceable.

Tangential Section. As the Radial, but the rays appear as fine, hoary, coarse-celled lines about 1.0 mm. high (lens).

Type specimen received from the Governor of Lagos.

The structure of this wood is very uncommon and interesting.

No. 211. EAST INDIAN MAHOGANY. Species unknown.

PLATE XV. FIG. 133.

Physical Characters, etc. Recorded dry-weight 43 lbs. per cu. ft. Hardness Grade 4, compare Maple. Smell or taste none. Burns well : embers glow in still air. Solution pinkish-brown.

Grain. Rather coarse and open. Surface rather dull, relieved by the numerous glistening drops of resin in the otherwise dull pores.

Bark.?

Colour. Dull brown, greyish-brown, reddish : quite uniform.

Anatomical Characters. Transverse section :—

Pores. Readily visible, size 1 to 2, moderate-sized, somewhat variable : in radial, subdivided groups of 10 or more pores uniformly scattered : 10 to 20 per sq. mm., oftener the lesser number.

Rays. Need lens, size 5, fine, uniform : equidistant, a pore-width or less apart : scarcely avoiding the pores : 6 to 10 per mm. of the same density but of lighter colour than the ground-tissue.

Rings. Indistinguishable.

Soft-tissue. In very fine lines a little coarser than the rays, size 4, in very close, concentric circles about a pore-width apart connecting the pores.

Pith.?

Radial Section. A shade lighter than the Transverse section, with a trifle more lustre. Pores very prominent, being exposed in numbers close together. Rays just visible in certain lights. Rings indistinguishable.

Tangential Section. As the Radial, but the rays are imperceptible with lens: fine lines about 0·3 mm. high. Pores prominent but much less so than the radial in the radial section.

Type specimen from commercial sources, unauthenticated.

No. 212. QUEBRACHO. Species unknown.

PLATE XV. FIG. 134.

Alternative Names. Quiebrahacha or Break-axe : Iron-wood : Axemaster. Quebracho colorado (46).

Source of Supply. (Tunas de Zazas.)

Physical Characters, etc. Recorded dry-weight 65–70 lbs. per cu. ft. Hardness Grade 1, compare Ebony. Smell or taste none. Burns well : embers glow in still air. Solution with water the colour of the wood, but pale.

Grain. Fine, close and dense. Surface bright.

Bark. ?

Uses, etc. Cabinet-making and other purposes where extreme hardness is desirable. Easily confused with another wood which passes under the same name, see No. 211 and also with Jamaica Cogwood.

Colour. Heart-wood red or dark red. Sap-wood. ?

Anatomical Characters. Transverse section :—

Pores. Need lens, size 4, rather fine, little variation : evenly scattered, sometimes a narrow zone poor in pores : single or in compact groups of from 2 to 10 pores : often filled with yellow or ruby resin or gum.

Rays. Need lens, size 5 to 6, uniform : equidistant : many, 8 to 10 per mm. : tapering both ends : lightly avoiding the pores if at all : gently undulating : red or brown : scarcely as dense as the ground-tissue.

Rings. Doubtful : clear or not : sometimes a zone in the outer part of the ring, which is poor in pores, at others a crowded zone in the inner part or even a vague line of (apparently) soft-tissue.

Soft-tissue. Very little : in very narrow rings encircling the pores or groups : very difficult to see in the solid.

Pith. ?

Radial Section. Pores. Clear though small : rather darker lines filled with resin. Rays, inconspicuous : very small flakes. Rings, vague and rarely traceable.

Tangential Section. As the Radial, but the Rays appear as minute lines about 0·5 mm. high : need lens.

Type specimens from commercial sources, not authenticated. It is reputed to be the wood of Aspidosperma Quebracho or of Quebrachia Lorentzii. Griseb. (syn. Loxopterygium Lorentzii, Griseb.). Its structure agrees with that of several species belonging to the Natural Order to which the latter species belongs yet there is very little ground for affirming that this wood should be placed in it. The name "Quebracho" is very commonly applied to very hard woods, and the resemblance of the specific names to the popular one is a very unsafe guide. As regards Aspidosperma, I think that name may be safely discarded, as the structure of our present species bears no resemblance to the woods of the Apocynaceae. (See Wiesner, L. 12, p. 1000.)

No. 212a. QUEBRACHO. Species unknown.

PLATE XV. FIG. 134.

I have met with a wood under this name which is extremely similar to the foregoing both in appearance and structure. It may be only a variety, but the following differences seem to point to a different, though allied, species.

Physical Characters, etc. Recorded dry-weight 83½ lbs. per cu. ft. Burns badly and supports a flame with difficulty. Reaction with iron salts black turning greenish. Surface has a rather greasy lustre. Contains more tannin than the foregoing.

Colour. Quite uniform nut-brown.

My specimen, sent me by Mr. Wm. Sinclair, comes from Africa. It is imported in small sizes in the round. This agrees fairly, closely with Wiesner's description of Schinopsis (Quebrachia), but he does not state from whence his specimens come (L. 12, p. 964).

No. 213. GUAYAQUIL LIGNUM-VITAE. Species unknown.

Physical Characters, etc. Recorded dry-weight 49 lbs. per cu. ft. Hardness Grade 2, compare Boxwood. Smell or taste none. Burns indifferently well : heat expels a red resin or gum : embers glow in still air.

Grain. Very fine, open and dense. Surface dull with much duller pores : not cold to the touch : no exudation.

Bark.?

Uses, etc. An inferior substitute for Lignum-vitae (Guaiacum, No. 16), with which it has nothing whatever in common.

Colour. Heart-wood nut-brown, uniform in colour. Sap-wood ?

Anatomical Characters. Transverse section :—

Pores. Visible to the unaided eye, size 2 to 3, uniform : scattered evenly but usually a zone in the outer side of the ring with few pores : 13 to 25 per sq. mm. : single or in subdivided groups of 2 to 4 pores which appear light brown in the solid : some red-coloured contents : shine after moistening.

Rays. Need lens, size 5, fine, uniform : equidistant : long : very nearly straight : brown : denser than the ground-tissue : numerous 6 to 9 per mm. : the width of a large pore or less apart.

Rings. Doubtful : a zone of dense wood free from pores at intervals and an extremely fine boundary line.

Soft-tissue. Perhaps the fine boundary-line : also encircling and sometimes concentrically linking the pores.

Radial Section. A shade lighter than the Transverse section, Pores open, empty, cellular grooves, some shining, others red but not quite filled with resin. Rays, need lens. Rings, not traceable.

Tangential Section. As the Radial, but the rays are minute lines about 0·25 mm. high.

Type specimens from commercial sources, unauthenticated.

No. 214. CELERY PINE. Phyllocladus trichomanoides. D. Don.

PLATE XVI. FIG. 136.

Natural Order. Coniferæ.

Synonyms. P. rhomboidalis. Rich.

Alternative Names. Celery-topped Pine (12). Celery-leaved Pine (61). Tauekaha or Tanekaha (91).

Source of Supply. New Zealand only : "almost confined to the Auckland district" (91).

Physical Characters, etc. Recorded dry-weight 47½ lbs. per cu. ft. Hardness, Grade 6, compare English Beech or rather softer. Smell faint but when worked, like bad cheese. Taste terebinthine like Pine. Burns well, ignites readily : no specific aroma : embers glow dully in still air. Solution colourless.

Bark. Surface of the wood below the bark is reddish-brown, coarsely channelled and smooth to the touch.

Uses, etc. "Strong, fit for spars, planking and carpentry generally" (61). "Affords timber 40-70 ft. long by 1-3 ft. in diam." (91). "Durable, especially in moist situations" (57). Hard to saw. A compact wood for a Conifer.

Authorities. Perceval (91), p. 66. Laslett (61), 434. Kew Guide (57), p. 79.

Colour. Sap-wood brown in my specimens, and darker than and sharply defined from, the white or brownish-white heart-wood (perhaps the sap-wood in my specimen is tainted ?).

Anatomical Characters. As those of Pinus sylvestris No. 242, but without either horizontal or vertical resin canals. Autumn wood a band of much darker and denser wood yet gradually merging into that of the Spring. Rings sharply defined and appearing in bold bands and loops in tangential section (plank-wise) much resembling those of Deal. Rays visible by contrast of lustre on a cleft surface.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 215. YEW TREE. Taxus baccata. Linn. (not of Hook or Thun.)

PLATE XVI. FIG. 136.

Natural Order. Coniferæ.

Sources of Supply. Europe, India, Canada.

Alternative Names. Deodar (God's Tree) in some parts of the Himalayas. For others in the various dialects of India see Gamble and Watt.

Synonym. T. baccata var. canadensis. Gray.

Physical Characters, etc. Recorded dry-weight 40–57 lbs. per cu. ft. Hardness Grade 5, compare English Ash. Smell none. Taste bitter (develops slowly upon the tongue). Burns with a lively but quiet flame and little if any smell ; embers glow in still air. Solution with water very little, colour slightly brownish ; more afterwards extracted by alcohol.

Bark. Red, about $\frac{3}{16}$ inch thick or less, leathery, smooth, scarcely fissured ; lenticels canoe-shaped ; falls away in thin, flat scales at length.

Grain. Extremely fine and even. Surface scarcely bright.

Uses, etc. "Turnery, carving, toys" (69). "Takes black stains well and then resembles Ebony" (69). "Difficult to split . . . very durable" (106). "Chair-making, walking-sticks, whip-stocks . . . a suitable wood for bows, . . . not now obtainable" (113). "The hardest, heaviest and toughest of the European woods" (129). "Incense—works and polishes well" (37). "Takes and retains a polish for a long time" (69). "Of unlimited durability" (131).

Authorities. Kew List Conif. (58), p. 21. Nördlinger (86), vol. iii. p. 8. Schwartz (106), p. 476. Stevenson (113), p. 142. Holtzapffel (48), p. 110. Westermeier (129). Gamble (37), p. 413. Mathieu (69), p. 511. Macoun (66), p. 463. Wiesner (131), L. 6, p. 166. Ditto (130). Watt (127).

Colour. Brown, reddish-brown, orange-brown, "reddish-chestnut," (69). Fades upon exposure. Heart-wood sharply defined from the dirty-white sap-wood which is about 8 rings wide.

Anatomical Characters. Transverse section :—

Pores or resin-canals. 0.

Rays. Need lens, fine, size 5–6 ; denser than the ground-tissue : appear slightly different upon either side of the ring-boundary as though of different vigour. Colour orange, especially in a transparent section ; translucent like gum ; more resinous than the adjacent tissue ; 9–15 per mm. ; large ones rare if any. "Of one row of cells only" (131). Extend over many rings.

Rings. Very clear. The boundary varies from a line of slight contrast to a distinct Autumn zone ; rarely developed to more than a line to the unaided eye.

Ground-tissue. Resin-cells here and there in the Summer wood, isolated ; near the thickest part of the rays the cells are compressed laterally ; lustre pearly ; resin often present in the Autumn wood.

Pith. Soft, very dark brown, about 0·5–1·0 mm. wide, of very large cells.

Radial Section. Slightly lighter in shade than the Transverse section. Rays, need lens, minute, orange-coloured, translucent flakes of large cells containing resin (micro.). Ring-boundaries very distinct, darker lines which appear sharply cut.

Tangential Section. As the Radial, but the rays appear as minute, very numerous, orange-coloured lines of one row of cells about 1·0 mm. high ; resin-ducts not apparent, no resin globules. Rings appear as sharply-defined (not fringed) loops. Microscopically a distinction may be drawn between this species and all other Conifers by "the narrow, pitted, spirally-thickened wood-cells and the small amount of Wood-parenchyma" (131), p. 150. Fig. 82.

No. 216. WESTERN YEW. Taxus brevifolia. Nutt. (not Hort.)

PLATE XVI. FIG. 136.

Natural Order. Coniferæ.

Synonym. T. baccata. Hook. T. Lindleyana. Murray.

Alternative Names. Pacific, Californian or Oregon Yew (49).

Sources of Supply. Canada and the United States.

Physical Characters, etc. Recorded dry-weight 40 lbs. per cu. ft. Hardness Grade 6, compare Walnut. Smell little if any. Taste astringent. Burns very well without aroma : embers glow brightly in still air and consume very slowly : a good fuel : little ash. Solution with water brownish : with alcohol colourless.

Grain. Extremely fine and even. Surface scarcely bright, slightly frosted.

Bark. Thick, fibrous, of one layer about ⅛–3/16 inch thick. "Thin reddish-brown, . . . exfoliating in fibrous strips or flakes off in irregular scales" (49).

Uses, etc. "Strong, elastic, very durable in contact with the soil, . . . fence-posts, turnery, paddles, bows" (49). "Strong, brittle" (100).

Authorities. Hough (49), pt. vii. p. 48. Sargent (100), p. 185.

Colour. Heart-wood brownish-red, uniform, darkening but not fading on exposure, sharply defined from the whitish sap-wood, which is from ½–¾ inch wide. "Light, bright red, the thin sap-wood yellow" (100).

Anatomical Characters. As those of Taxus baccata No. 214, but the wood is less resinous. The rays are not noticeably resinous and the resin cells of the wood are not easily found on a solid section.

Type Specimens authenticated by Hough.

No. 217. NEW ZEALAND RED PINE. Dacrydium cupressinum. Soland.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Source of Supply. New Zealand. "Common throughout the Colony" (91).

Alternative Name. Rimu (A. G.).

Physical Characters, etc. Recorded dry-weight 33½–45 lbs. per cu. ft. Hardness Grade 8, very soft, compare American White Pine. No smell. Taste faintly astringent. Burns well with a long, smoky flame : embers glow in still air and consume away very rapidly. Solution with water pinkish or almost colourless : brown ppt. upon addition of potash. After the wood has been extracted with both water and alcohol it yields a deep red solution when boiled with Potash.

Grain. Very fine, uniform and straight. Surface smooth and bright especially in tangential section.

Bark. Deep red, fibrous, laminated, silky, soft, frosted in longitudinal section.

Uses, etc. "Furniture . . . has more figure than Kauri" (50). "Yields timber 10–30 inches square by 20–50 ft. long, would be useful to the cabinet-maker, . . . appears to be deficient in tenacity" (60). "Building timber, interior finish, railway-sleepers, wood-paving, ship-building . . . young trees are no good for export . . . timber 40–80 ft. long by 2–5 ft. in diam. . . . that grown upon the hills is the best quality . . . nearly

equal to English Oak in strength . . . the most widely distributed wood in New Zealand" (91). Works like English Birch, saws and planes easily and sweetly, but the grain "picks up" in little scales. "Shrinks laterally in drying, . . . spars . . . more used in carpentry than any other wood of the south of New Zealand" (91).

Authorities. Perceval (91), pp. 14 and 30. Laslett (60), p. 400. Ditto (61), p. 433. Collinson (24). Smith (111), p. 353. Kirk (59). Agent-General for N.Z. (A.G.).

Colour. Heart-wood blush-red or brown well defined from the yellowish-brown sap-wood. "Heart deep red, sap-wood less than 4 inches in trees 4 feet in diam., but proportionally greater in smaller trees" (91). "Much varied in colour . . . brown or chestnut with a nice diversity of shade and figure" (60). "Reddish-brown resembling Rose-wood" (66).

Anatomical Characters. As those of Podocarpus dacrydioides No. 210, with the following differences :—

Rays. Visible with difficulty with lens in the solid wood in all sections. There are also many cells filled with bright crimson contents which show up when moistened.

Type specimens authenticated by the Forest Officer to the Government of New Zealand.

No. 218. SILVER PINE (New Zealand). Dacrydium Westlandicum. T. Kirk.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Alternative Names. Manao (A. G.) Westland Pine (91).

Source of supply. New Zealand only.

Physical Characters, etc. Hardness Grade 7, compare English Birch : harder than Kahikatea. Recorded dry-weight 41 lbs. per cu. ft. Smell slightly fragrant when worked. Taste astringent, even bitter. Burns very well with a long, smoky, quiet flame and a very slightly tarry smell : embers glow in still air. Solution with water a beautifully clear green (? if with distilled water) : becomes a deeper green upon the addition of potash, which throws down a brownish ppt.

Grain. Very fine and even : moderately dense. Surface smooth and bright.

Bark. Closely adherent, red, ¼–½ inch thick : of three layers : the inner soft, brown and fibrous in structure : the middle very thin, hard pinkish or purplish serving to mark off the outer rough, brown, crumbling scales of the external layer. An unusual form of bark.

Uses, etc. Planes and saws cleanly and smoothly, something

after the manner of Deal. "Infinitely stronger, tougher and more durable, though smaller, than the White Pine (Kahikatea), . . . timber 50 ft. long by 2½ ft. diam. may be met with, . . . marine-piles . . . almost imperishable, . . . sleepers, . . . of great strength and durability" (91).

Authorities. Perceval (91), p. 53. The Agent-General for New Zealand (A.G.).

Colour. Light brownish-yellow: heart-wood well defined from the whitish-brown to pure white, sap-wood, which is 1 to 2 inches wide.

Anatomical Characters. As those of Podocarpus dacrydioides No. 219, with the following variations: Rays, on the limit of vision. Rings clearly defined by a narrow, dense, darker boundary-line sharply defined from the summer wood of the same ring. The cells of this line are extremely fine. The rings are visible on a cleft surface in Radial section but scarcely traceable upon planed wood.

Type specimens authenticated by the Forest Officer to the Government of New Zealand.

No. 219. NEW ZEALAND WHITE PINE. Podocarpus dacrydioides. A. Rich.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Synonyms. D. excelsum. D. Don.

Alternative Names. Kahikatea. Not Kahikatoa (91), p. 12.

Source of Supply. New Zealand.

Physical Characters, etc. Recorded dry-weight 26¾–35 lbs. per cu. ft. Hardness Grade 8, very soft, compare White Pine of America (P. Strobus). Smell and taste none. Burns well and quietly with a slight, faint, sickly smell: embers glow in still air and leave a grey ash. Solution colourless.

Grain. Very fine, even and smooth. Surface bright, lustrous when cleft: rays dull: ground-tissue crystalline: warm to the touch.

Bark.?

Uses, etc. Works very much like White Pine (P. Strobus). "Cheap furniture, packing-cases and for works under cover, . . . the sap-wood ought not to be used in contact with damp ground. As a rule the logs are remarkably sound, . . . 150 ft. by 5 ft. diam. . . . 350 cu. feet in one tree by no means uncommon" (91). "Not considered durable" (61). "Canoes, . . . does not wear well, . . . liable to the attacks of a small worm" (60). "Is greatly superior to the American Spruce and would successfully compete with the best Baltic White Deal in the

English market" (59). I question this latter statement as it is not of equal quality to European Spruce, but it should replace it in Australia and at the Cape of Good Hope. "Dries light, shrinks laterally, does not last more than 3 years in the ground" (24). Saws as easily as American White Pine: planes smoothly but being brittle is inclined to crumble.

Authorities. Laslett (60), p. 434. T. Kirk (59), p. 462. Kew Cat. Conif (58), p. 23. Perceval (91), p. 53. Collins (24).

Colour. Quite uniform, pure white or yellowish-white: yellow in the Transverse section. "Sap-wood large in proportion to the Heart" (91).

Anatomical Characters. Transverse section:—

Pores or resin ducts absent.

Rays. Just visible on account of their white appearance in the solid wood: size 5: 8–10 per mm.: gently undulating: large ones rare if any.

Rings. Perceptible, very little contrast between one zone and another: the Autumn ?zone generally a band: contour gently undulating.

Ground-tissue. Very coarse in radial rows of cells, which are not sharply separated from each other.

Radial Section. The rays show up well by contrast of lustre (not of colour) with the ground-tissue. Rings clear or only just perceptible.

Tangential Section. As the Radial, the rays are scarcely visible but they are deep, about 1 mm. high: the rings are a little more easily traceable. There are also a number of lines in this section of the nature of which I am doubtful.

Type specimens authenticated by the Forest Officer to the Government of New Zealand.

No. 220. MIRO. Podocarpus ferruginea. G. Benn.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Source of Supply. New Zealand only.

Alternative Names. Black Pine (60). Bastard Black Pine (12). Miro toromiro (91).

Physical Characters, etc. Recorded dry-weight 41½–52 lbs. per cu. ft. Hardness Grade 7, compare English Beech. No smell or taste. Burns well with a long, quiet flame and little aroma: embers glow in still air. Solution pinkish unchanged by potash or slightly darkened only: no ppt.

Grain. "Straight and even, compact" (91): fine. Surface very dull except in Radial section, where it is a little brighter.

Bark. Brown, ¼–½ inch thick, hard, smooth though uneven

as though "thumbed": covered with small papillae: separating in thin friable scales. "Like Kahikatea but smoother" (24).

Uses, etc. "Of great strength but not durable in contact with the ground: useful, durable and strong under cover, . . . timber to 90 ft. long by 3 ft. in diam. . . . less easily worked than Kauri or Rimu, . . . piles, resists the teredo" (91). "Some of the logs are nicely figured, . . . very suitable for cabinet-makers' work, turnery, etc., . . . would no doubt be fit for civil architecture" (60). "Like Elm, short-grained, knotty, durable but not plentiful nor much used (in N. Z.)" (24).

Authorities. Collinson (24). Perceval (91), pp. 14 and 50. Laslett (60), p. 401. Boulger (12), p. 480. Kew Guide (57), p. 79.

Colour. Heart-wood uniform cinnamon-brown, irregular in contour: not well defined from the light brown sap-wood. "Dark and irregularly shaped" (91). "Light to dark brown" (60).

Anatomical Characters. As those of Podocarpus dacrydioides No. 219 with the following differences:—Rings distinct. Rays rarely visible in Transverse section though very fine, visible, brown lines in Radial section: they need the lens in Tangential section and do not often exceed 0·1 mm. high.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 221. NEW ZEALAND BLACK PINE. Podocarpus spicata. R. Br. (not Poepp. and Endl.)

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Source of Supply. New Zealand only.

Alternative Names. Matai: Mai (24).

Physical Characters, etc. Recorded dry-weight 35-49¼ lbs. per cu. ft. Hardness Grade 7, compare English Beech. Smell faint, something like hay. Taste astringent. Burns well with a long, quiet, not very smoky flame and a slightly tarry smell: embers glow in still air. Solution faint brownish turning slightly greenish upon the addition of potash.

Grain. Very fine, compact and even. Surface bright. "Smooth and silky" (91).

Bark. Deep red, about ¼ inch thick, one layer, smooth, leathery, wrinkled and covered with minute papillae, not fissured. "Like that of Kahikatea" (24).

Uses, etc. "Very good for all joiners' work, easy and fine working, . . . does not shrink in drying, being almost the only wood of N. Z. that does not ? . . . greasy, brittle, . . . timber

rather preserves than injures it" (Swainson quoted by Collinson) (24). "Would be a good substitute for Mahogany" (60). "Canoes of this wood frequently serve three generations, . . . interior fittings, veneers, sleepers, . . . timber 120 feet long by 12 feet in diam. . . . a general-utility wood, resists the teredo, . . . piles, bridges, wharves, . . . very durable, easily worked, . . . wood paving, . . . never warps or twists" (91). Works beautifully freely like Deal.

Authorities. Perceval (91), pp. 14 and 41. Laslett (60), p. 401. Ditto (61), p. 434. Collinson (24).

Colour. Heart-wood rosy red gradually passing over into the white sap-wood, which is about 3 inches wide. "Rich red, . . . varies in colour in the same plank, . . . sometimes iridescent" (91). "Reddish, resembles Mahogany" (61). "Three kinds, the red, the pale yellow (and a third not mentioned)" (24).

Anatomical Characters. As Podocarpus dacrydioides No. 219.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 223. REAL YELLOW-WOOD. Podocarpus Thunbergii. Hook. (not Siebold)

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Synonyms. P. latifolia, R. Br. P. latifolius, Boulger (12).

Alternative Names. Upright Yellow-wood: Cape Geelhout (19). Umceya (12).

Sources of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 33½–38 lbs. per cu. ft. Hardness Grade 7, compare Beech. Smell none. Taste "dealy" or vapid if any. Burns badly, the flame readily expires: embers glow in still air: a quiet, smoky flame. Solution colourless.

Grain. Very fine and even. Surface satiny and frosted.

Bark. Reddish-brown, about ¼ inch thick: soft, fibrous, cracked in vertical lines: frosted: apparently of two layers.

Uses, etc. Works of construction generally: not ornamental nor susceptible of much finish. "Rural implements, . . . 10–15 in. in diameter" (19). Works easily.

Authorities. Nördlinger (86), vol. vii. p. 7. Laslett (60), p. 385. C. S. Almanack (19). Boulger (12).

Colour. Uniform yellow. No distinction between sap- and heart-wood.

Anatomical Characters:—

Resin Canals. None.

Rays. Scarcely visible, size 5–6, very fine: very many about

8–13 per mm., but apparently one to each row of cells: short: taper: slightly undulating.

Rings. Very indistinct, just traceable with microscope: beautifully uniform: scarcely any contrast between the inner and outer side of the ring: contour undulating.

Ground-tissue. Spongy and coarse: extremely uniform in the size of the cells, but some variation one row with another: cells in regular radial rows with little reduction in size outwards: no resin cells.

Pith. ?

Rays. In radial section scarcely perceptible through lack of contrast, yet evident in certain lights. Rings almost imperceptible. Ground-tissue lustrous, frosted and brilliantly crystalline when viewed under the lens.

Type specimens authenticated by the Forest Officer to the Government of Natal: also from a log sent to the Colonial and Indian Exhibition.

No. 224. COMMON YELLOW-WOOD. Podocarpus elongata. Herit.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

The P. elongata, E. Mey, is the P. Meyeriana, Endl. The specific name is frequently spelt "elongatus."

Source of Supply. South Africa.

Alternative Names. Outeniqua: South African Yellow-wood: African Podocarpus. White Yellow-wood and Geelhout in Natal (19). Bastard Yellow-wood: Umkoba in Cape Colony (12).

Physical Characters, etc. Recorded dry-weight 34–45 lbs. per cu. ft. Hardness Grade 8, compare White Pine (P. Strobus). Smell or taste none. Burns well with a quiet, lively flame and rather pleasant smell. Solution colourless.

Grain. Extremely fine and even. Surface satiny: warm to the touch.

Bark. Hard, about ⅛–¼ inch thick: brown, smooth, not fissured nor fibrous but wrinkled: of one layer only.

Uses, etc. "Beams, planks, 3–7 ft. wide" (19). Works of construction generally. Saws exceptionally easy.

Authorities. Kew Cat. Conif. (58), p. 23. Nördlinger (86), vol. iv, p. 7. Laslett (60), p. 385. Cape Land Almanack (19). Boulger (12).

Colour. Brownish-white.

Anatomical Characters. As those of P. Thunbergii, No. 22?. Rings sometimes clear: at others very indistinct, and just

traceable with microscope. Ground spongy and fine for a Conifer containing rows of resin-cells in zones.

Pith. Small, about 1·0 mm. wide.

Rays. In radial section not perceptible with lens, and smaller and of less height than those of P. Thunbergii.

Type specimens authenticated by the Forest Officer to the Government of Natal, and also from a log sent to the Colonial and Indian Exhibition.

No. 225. PENCIL CEDAR. Juniperus virginiana. Linn.

PLATE XVI. FIG. 139.

Natural Order. Coniferæ.

Synonyms. J. barbadensis, Michx. [This is given as a synonym of J. occidentalis, Hook, by Macoun (66).]

Sources of Supply. United States of America and Canada.

Alternative Names. Red Cedar: Savin (100). Virginische Wachholder, Bleistiftholz, Virginian Cedar (49). Sabino in Mexico (Kew MS.). Cedar, Potlood in South Africa (51).

Physical Characters, etc. Recorded dry-weight 20¾–35 lbs. per cu. ft. Hardness Grade 7, compare Deal. Smell sweet, fragrant. Taste sweet. Burns very badly and supports a flame with difficulty: aromatic: noisy: embers glow in still air. Solution very pale brown with water: pale red with alcohol. A spot of caustic potash solution sinks instantly into the wood, which it turns deep black, afterwards changing to purple.

Grain. Extremely fine, even and uniform. Surface shining when cleft, rather dull when planed.

Bark. About 1 inch thick, deep reddish brown: fibrous, the fibres easily rubbing off: deciduous, "peeling and hanging in loose strips: smooth when young" (49). Soft to the touch: inner layer about 1/16 inch thick.

Uses, etc. Pencil-making, pen-holders, fancy turnery. "Fence-posts, railway ties . . . most durable in contact with the soil . . . moth and insect-proof" (49). "A tree about 80–100 ft. high by 2–4 ft. 6 in. diameter: not strong, brittle, easily worked" (100). Fades when exposed to the light: turns brown with a spirit polish.

Authorities. Kew List Conif. (58), p. 31. Nördlinger (86), vol. iii. p. 8. Schwartz (106), p. 47. Stevenson (113), p. 209. Hough (49), pt. i. p. 76. Macoun (66), vol. iii. p. 46. Smith (111), p. 100. Holtzapffel (48), p. 79. Gamble (37), p. 411. Sargent (100), No. 339. Hutchins (51). Wiesner (131), L. 7, p. 163.

Colour. Heart-wood rich red, almost uniform : sharply defined from the white sap-wood. Heart slightly excentric.

Anatomical Characters. Transverse section :—

Pores or resin canals absent.

Rays. Need lens, size 7, just visible to good sight on account of their deeper colour : slightly denser than the ground : 10–16 per mm., apparently one between each row of cells : narrower and yet more easily seen than those of J. communis. " A crystalline efflorescence of Cedar camphor appears upon the surface of freshly-cut green wood " (131).

Rings. Very clear : boundary darker in colour and varying from a fine line to a distinct zone, frequently the latter : contour in long, gentle undulations : distinct though scarcely prominent : often like fine shading.

Ground-tissue. Rather coarse, with isolated, red resin-cells here and there.

Pith. ?

Radial Section. Slightly lighter than the Transverse section, practically uniform. Rays dull but conspicuous, small, dark red flakes, which show up against the shining ground : brilliant carmine : crystalline under the microscope.

Tangential Section. As the Radial, but the rays appear as lines about 1·0 mm. high of large round cells, containing a few drops of carmine resin. Rings appear as clear loops without fringes. The resin-drops make their appearance in the tracheids (fibres) of sap-wood long before they do in the rays.

Type specimens from commercial sources and also from the exhibit of the Mexican Government at the Paris Exhibition of 1900. Laslett mentions " Pencil Cedar " under the name of J. bermudiana. I imagine that this is an error, as that species is not so suitable for the purpose of making pencils. The specimen in the Kew Museum is quite different to the commercial article and to the specimens of J. virginiana in the same case.

No. 226. JUNIPER. Juniperus communis. Linn.

PLATE XVI. FIG. 139.

Natural Order. Coniferæ.

Sources of Supply. Europe.

Alternative Names. Gemeiner Wachholder in Germany : Genévrier commun in France (Génébre in Provence) (69).

Physical Characters, etc. Recorded dry-weight 33–41 lbs. per cu. ft. Hardness Grade 5, compare Ash. Smell agreeable though slight when dry. Burns well with quiet, lively flame and a little aroma, embers glow brightly in still air. Solution with water brownish : with alcohol afterwards golden brown.

Grain. Very fine, smooth, dense and even. Surface bright.

Bark. "Brownish-red, thin, fibrous" (37).

Uses, etc. Turnery. "Rated third class at Lloyd'." (60). "Very tenacious, compact, durable; works very freely and easily" (69).

Authorities. Nördlinger (86), vol. iii. p. 7. Schwartz (106), p. 477. Macoun (66), vol. iii. p. 462. Holtzapffel (48), p. 88. Westermeier (129), p. 62. Gamble (37), p. 411. Wiesner (131), L. 7, p. 161. Mathieu (69).

Colour. Brown or nut-brown. "Brownish-yellow" (69). "Reddish or pale violet in places" (131). In alternate dark and light zones, sharply defined from the white or yellowish-white sapwood. Heart slightly excentric.

Anatomical Characters. As J. virginiana, No. 225. Transverse section :—

Pores or resin ducts absent.

Rays. Need lens, very fine, size 7, or rather less: scarcely visible with lens: denser than the ground-tissue and very slightly deeper in colour: 10-18 per mm.: apparently one between each row of cells.

Rings. Very clear: boundary darker in colour: not often more than a mere line: contour undulating in long, gentle waves.

Ground-tissue. Pearly in a transparent section.

Pith. ?

Radial Section. Rays narrow, inconspicuous, slightly darker bands. Rings very distinct.

Tangential Section. As the radial, but the rays appear as innumerable brown dots about 1 mm. high: neither the cells nor the resin-drops are visible with a 2 in. lens (micro.): loops of the rings scarcely fringed: resin-containing cells appear in the sapwood.

Type specimens from commercial sources not authenticated, but checked by the specimens in the Museum No. 1, Kew.

No. 227. CANADIAN JUNIPER. Juniperus occidentalis. Hook. (not Hort. or Gord.).

PLATE XVI. FIG. 139.

Natural Order. Coniferæ.

Synonyms. J. excelsa, Pursh. J. virginiana, Linn.

Alternative Names. Pencil-wood (2). Western Red Cedar (66). Yellow Cedar: Western Juniper: Californian Juniper (49).

Sources of Supply. Canada and the United States of America.

Physical Characters, etc. Recorded dry-weight about 36 lbs. per cu. ft. Hardness Grade 7, compare Deal. Smell and taste similar to those of J. virginiana (Pencil Cedar), but the aroma

is less enduring. "Moderately odorous" (49). Burns well but embers soon die out and leave a carbonized stick. Solution with water clear: with alcohol faint brown, darkening and giving a ppt. with potash. Surface dull except in tangential section.

Grain. Fine, straight and even.

Bark. About ¼ inch thick, of two layers of equal thickness, the inner finely laminated (lens), the outer stripping in *stiff* layers, which are *harsh* to the touch. "Rather thin, of a rich purple-brown colour, composed of laminae of alternately purple and light-brown colours . . . becomes fissured with age" (49).

Uses, etc. "Very durable in contact with the soil" (49). Should be equally serviceable for pencil-making to the wood of J. virginiana commonly used, but would scarcely command the same price on account of its poorer appearance. "Fencing and fuel" (100).

Authorities. Macoun (66), p. 461. Hough (49), pt. vii. p. 47. Sargent (100), p. 181.

Colour. Heart-wood, uniform, rich pinkish-brown. Sap-wood whitish.

Anatomical Characters. As those of J. virginiana, No. 225, of which it might be taken to be a pale-coloured variety.

Resin-cells. Difficult to see with lens, probably on account of the paler resin.

Rays. Brown or yellow rather than red.

Type specimen authenticated by Hough.

No. 228. CLANWILLIAM CEDAR. Callitris arborea. Schrad.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Source of Supply. South Africa.

Physical Characters, etc. Recorded dry-weight 36 lbs. per cu. ft. Hardness Grade 7, compare Deal. Smell delightfully fragrant. Taste nauseous. Burns well with a powerful, breath-catching, but not unpleasant odour: embers glow in still air. Solution colourless.

Grain. Very smooth, fine and even. Surface rather dull but somewhat frosted: easily soils.

Bark. ?

Uses, etc. ?

Colour. Light brown or yellow. Not resinous.

Anatomical Characters. Transverse section:—

Resin-pores. None, but there are certain resinous cells in series simulating the pores (without lining-cells): dark brown, fine, need lens: only locally numerous, especially near the pith.

Rays. Need lens, size 5, rather large for a Conifer: orange-coloured: straight, rapidly tapering: large ones rare, if any: 5–10 per mm.: cells round, laxer than the ground-tissue: not regularly spaced.

Rings. Clear even if not prominent: boundary apparently or actually a band of Autumn wood: some contrast, but nothing pronounced: the Summer and Autumn wood melt into one another.

Pith. Round, about 0·5 mm. diameter, of large spherical brown and white cells.

Radial Section. Rays readily visible, brown flakes: dull. Rings just traceable, fine lines. Ground-tissue bright, but scarcely crystalline.

Tangential Section. As the Radial, but the rays are just visible with lens: brown lines about 0·2 mm. high.

Type specimens from a log sent to the Indian and Colonial Exhibition.

No. 229. YELLOW CEDAR. Chamaecyparis nutkaensis. Spach.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Synonyms. Thuya excelsa, Bong. Cupressus nutkaensis, Hook.

Sources of Supply. United States and Canada.

Alternative Names. Cypress: Yellow Cypress (66).

Physical Characters, etc. Recorded dry-weight 20¾ lbs. per cu. ft. (100). I have no other details, as I do not possess a solid specimen.

Uses, etc. "Not strong: easily worked: very durable in contact with the soil, . . . timber is manufactured from the buried trunks of this species dug from peat swamps . . . boat-building, wooden-ware, cooperage, shingles, telegraph and fence posts and railway-ties" (100). "Sometimes exceeds 6 ft. in diam." (66). "Very durable and credited with resisting the teredo . . . greatly valued for interior finishing, and commands a higher price than either the Douglas Fir or Arbor vitae" (65). "Paddles, carving, boxes and articles of domestic use (amongst the Indians) . . . liable to shrink lengthwise unless well seasoned" (2).

Authorities. Macoun (66), p. 461. Ditto (65), p. 31. Anderson (2), p. 11. Sargent (100), p. 178.

Colour. "Light brown tinged with red, growing darker on exposure: the sap-wood lighter" (100).

Sources of Supply. New Zealand and Tasmania.

Physical Characters, etc. Recorded dry-weight 28 lbs. per cu. ft. Hardness Grade 7, compare Spruce. Smell or taste none. Burns well with a long, smoky flame : no aroma : no juice expelled by heat : embers glow in still air. Solution colourless : gives a copious, brownish ppt. upon the addition of potash.

Grain. Exceedingly fine, close and even. Surface bright, but much duller than that of Totara.

Bark. Deep lurid red : fibrous : separates in long, bast-like strips : thickness about ⅛ inch : uniform in structure, but of a dull brown colour near the wood. A silvery gleam is seen between the layers when separated.

Uses, etc. Works like Deal, but though it planes easily the surface "picks up" in little scales. "A tree 60–100 ft. high by 3–5 ft. in diameter . . . carving, planks and spars" (111).

Authorities. Smith (111), p. 234. Boulger (12), p. 418.

Colour. Rose-red : brownish-red heart-wood, not sharply defined from the lighter sap-wood, which is about 1 inch wide.

Anatomical Characters. As those of Podocarpus dacrydioides, No. 219, but there are a large number of single cells filled with dark gum or resin, resembling the pores of Dicotyledonous wood, when examined with a lens, in both transverse and vertical sections. They need the microscope to determine their true nature. This feature serves to distinguish this wood from Totara, Rimu, and many other Conifers.

Pith. Three-sided, about ⅛ inch diameter.

Type specimen authenticated by the Forest Officer to the Government of New Zealand.

No. 232. GIANT REDWOOD. Sequoia sempervirens. Endl.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Synonyms. S. taxifolia, Kir. S. gigantea, Endl. Gigantabies taxifolia, Wels.

Alternative Names. Americanische Rothholz (131). Sequoia à feuilles d'if : Redwood of the coast (49).

Physical Characters, etc. Recorded dry-weight 24½–29 lbs. per cu. ft. (With remarkable unanimity the specific gravity is stated by Sargent, Hough, Mouillefert and Wiesner to be 0·4208, 0·4208, 0.420 and 0.42). Hardness Grade 8, the softest timber-wood of commerce : splinters can be torn away with the finger-nail. Smell none. Taste slightly astringent. Burns well with little, if any, particular aroma : embers glow in still air and consume away

to the ash. Solution faint brown: with alcohol faint pinkish, turning darker and browner and yielding a ppt. with potash.

Grain. Fine, surface lustrous, i.e. frosted.

Bark. "Cinnamon-coloured with large prominent ridges, often 12 or more inches in thickness" (49).

Uses, etc. "Very durable . . . the most valuable of the woods of the Pacific region of United States of America . . . construction furniture and pencils" (131). "Not strong, brittle . . . very durable in contact with the soil . . . splits with facility: railway-ties, fencing, shingles, water-tanks" (49). Linings for drawers in England.

Authorities. Wiesner (131), p. 160. Sargent (100), p. 142. Smith (111), p. 348. Mouillefert (79), p. 527. Hough (49), pt. vii. p. 46.

Colour. Heart-wood, uniform rich red: sharply defined from the nearly white sap-wood. "Heart vinous red" (111). "Light red" (49).

Anatomical Characters. As Callitris, No. 228, but very coarse-celled, and the isolated resin-cells are clearly visible in a transparent section, with slight magnification, as ruby beads. The wood is usually slowly grown. In a section by Hough in my possession there are 172 annual rings in the radial distance of 3⅛ inches. The cells of the wood are clearly visible with a pocket lens: the widest ring of the section just mentioned has 25 rows of cells only and the narrowest only two rows.

This wood is indistinguishable from that of Sequoia gigantea (the Big Tree), but the latter, I believe, is not met with in commerce. The Giant red-wood may be confused with the wood of Thuya gigantea, but it has no smell and does not separate as a rule tangentially at the Autumn layers when bent, as does the latter wood.

Type specimens authenticated by Hough and also from commercial sources.

No. 233. KAURI PINE. Agathis australis. Steud.

PLATE XVI. FIG. 140.

Natural Order. Coniferæ.

Synonyms. Dammara australis, Lamb.

Alternative Names. Cowrie, Cowdie, or New Zealand Pine. Southern Dammar, New Zealand Pitch Tree (113). Kawri (111). Not the Kauri of Queensland, which is A. robusta, the Dundathi Pine.

Source of Supply. New Zealand only.

Physical Characters, etc. Recorded dry-weight 30–39 lbs. per cu. ft. Hardness Grade 7, compare Alder. Smell very slight:

" pleasant and agreeable when worked " (60). Taste rather bitter. Burns very well, with a long, quiet, smoky flame and a strong, agreeable, cedar-like aroma : embers glow in still air : ash blackish. Solution with alcohol faint brown : with water colourless.

Grain. Extremely fine, even, and smooth. Surface lustrous, satiny : the ground-tissue glossy, but the rays dull.

Bark. Smooth, not fissured : 1–1¼ inch thick : woody : one layer : red, and covered with papillæ.

Uses, etc. " Generally sound, polishes well, free from knots, wears evenly, shrinks very little, much more durable than any other Pine . . . yacht-decks . . . one of the best woods a carpenter can take in hand . . . generally free from defects " (60). Laslett gives much valuable information. " Of great size, . . . 160 ft. high by 15 or even 24 ft. diameter " (91). " Stronger and more durable than the best Red Deal, . . . tougher and more elastic than the American Spruce, while it is more easily worked than the Red-wood of California " (59). This last is perhaps a little overdrawn. There is striking similarity in the appearance of this wood to that of Liquidambar styraciflua (No. 97). If not too costly Kauri should make good paving blocks. " Many of the wooden houses of Auckland erected half a century ago are still standing, the timber showing no signs of decay " (59).

Authorities. Holtzapffel (48), p. 100. Laslett (60), p. 388. Ditto (61), p. 433. Stevenson (113), p. 211. Kew Cat. Conif. (58), p. 59. Smith (111), p. 148. Bailey (15), p. 135. Perceval (91), p. 24. Kirk (59).

Colour. Whitish-brown, brownish or reddish-brown. " Pale straw " (61). " Yellowish white or straw " (113). Sharply defined from the sap-wood, which is about from 3–5 inches wide or " more on poorly grown trees " (61).

Anatomical Characters. Transverse section :—

Pores or resin-canals absent.

Rays. Just visible upon a clean cut section, but seem more prominent when the wood is left rough from the saw, when they may be mistaken for the ring-boundaries. Size 5 : red : contrast well with and are denser than the ground-tissue : tough, and can be separated like threads from a very thin section : taper rapidly : many, but very irregular, about 1–8 per mm.

Rings. Clear at times, but not in all specimens : boundary a line of slight contrast : *no smoky zones.*

Ground-tissue. Cells in radial rows, irregular in size one row with another, but the cells in each row diminish a little in size from within outwards.

Pith. ?

Pesse : Serente " Alpes " : Sapin gentil : Pinesse (5) : Bois blanc du Nord : Sap : Epicea : Pesse : Sapin blanc du Nord : Sapin de Perse in France (28). Fichte (4) : Gemeine Roth Tanne : Lafie (5) : Pechtanne : Edeltanne (36).

Sources of Supply. The mountains of North and Central Europe. Introduced into many other countries with a similar climate.

Physical Characters, etc. Recorded dry-weight 21–48½ lbs. per cu. ft. Hardness Grade 7, compare English Birch, but rather softer. Burns well, ignites readily, extremely noisy : embers glow in still air : ash brown and small in quantity : practically no smell, otherwise as Pinus sylvestris. Surface of the ground-tissue satiny and brilliant : crystalline under the lens.

Bark. When "young, reddish-brown, scaling in very fine flakes : when old, covered with roundish corky scales."

Authorities. Kew List (58), p. 65. Nördlinger (86), vol. iii. p. 9. Schwartz (106), p. 477. Laslett (60), pp. 313. 338. Stevenson (113), p. 186. Smith (111), p. 175. Petsche (92), p. 75. Wiesner (131), L. 6, p. 147. Mathieu (37), p. 540.

Uses, etc. Light, elastic : paper-pulp, scaffold-poles, spars, etc., match-boarding, deals, packing-cases and other purposes too numerous to mention. Splits readily and straight : fairly durable. Fiddles and sounding-boards. "The better quality from the higher altitudes " (37).

Colour. White or brownish. No distinction between sap-wood and heart-wood. " Light red from the North of Europe, off marshy soil " (37).

Anatomical Characters. Similar to those of Pinus sylvestris, No. 242. The rings are very clear : the boundary darker in colour than the rest of the wood, varying from a fine line to half the width of the ring : gently undulating in contour. The horizontal resin-ducts are not distinguishable in the solid wood with the microscope (2 inch) from the ordinary rays in tangential section. In some kinds (Hazelfichten) there are " ray-like lines resembling the rays of the Hazel " (37). In longitudinal section the rings boundaries are not prominent except in fast-grown wood.

Type specimens from commercial sources and from trees known before felling.

No. 236. WHITE SPRUCE. Picea alba. Link.

PLATE XVI. FIG. 137.

Natural Order. Coniferæ.

Synonyms. Abies alba, Michx. A. canadensis, Mill. Pinus alba, Lamb. Picea laxa, Ehrh.

Alternative Names. Single Spruce (60). Schimmel Fichte: Echte, Deutsche or Weiss-tanne. Sapin blanc: Epinette blanche (92).

Sources of Supply. Newfoundland and Labrador to the Rocky Mountains and north-west to Alaska. United States, Nova Scotia and New Brunswick to twenty miles of the Arctic Sea (Richardson).

Physical Characters, etc. Recorded dry-weight 25½–32¼ lbs. per cu. ft. Hardness Grade 7, compare European Spruce. The Summer wood is as soft as that of Sequoia: the Autumn about as the same as that of the Common Spruce (P. excelsa). Smell when burning faint but pleasant. Otherwise as Picea excelsa.

Grain. Straight, compact. Surface lustrous, satiny.

Bark. Thin, brown: not rough, scaling in very small flakes.

Uses, etc. "Construction, musical instruments, paper-pulp . . . sonorous . . . not distinguished from Black Spruce in commerce" (49). Moderately strong.

Authorities. Kew Cat. Conif. (58), p. 48. Laslett (60), p. 376. Hough (49), pt. iv. p. 43. Macoun (66), vol. iii. p. 469. Ditto (65), p. 94. Petsch (92), p. 105. Sargent (100), p. 204.

Colour. "Yellowish-white: sap-wood hardly distinguishable from the heart-wood" (49). Pure white.

Anatomical Characters. As those of Pinus sylvestris and Picea excelsa, Nos. 242 and 235.

Pores or vertical resin-ducts scarce but readily visible. The great difference in hardness between the Summer and Autumn woods of this species is almost the only character that can be used to distinguish this wood from that of P. excelsa.

Pith. Brown: about 0·5 mm. wide: apparently winged.

Type specimen authenticated by Hough.

No. 237. WESTERN SPRUCE. Picea sitchensis. Traut. (Carr.)

PLATE XVI. FIG. 137.

Natural Order. Coniferæ.

Synonyms. Pinus sitchensis, Bong. Pinus Menziesii, Lindl. Abies sitchensis, Lindl. A. Menziesii. Dougl.

Alternative Names. Menzies Spruce (66). Tide-land Spruce (49). Californian Coast Spruce (60). Black Spruce (12). Silk Spruce (79).

Sources of Supply. Canada (British Columbia) and the United States in the West.

Physical Characters, etc. Recorded dry-weight about 26¾ lbs. per cu. ft. (49). Hardness Grade 7, compare Alder. Taste

flat like Deal. Smell none. Burns with a lively, spurting, crackling flame: embers glow brightly in still air. Solution colourless.

Grain. Fine, straight and even. Surface satiny, frosted and even brilliant in Radial section.

Bark. Dark brown, rugged: of one layer, filled with coarse, hard whitish bodies and covered with a brittle skin. "Thin . . . rather smooth reddish bark, which flakes off in irregular scales" (49).

Uses, etc. "Coarse but strong and useful" (60). "Shrinkage unusually great" (2). "Attains a large size" (66). "No other tree of the West Coast is used for such varied purposes . . . very white: elastic, bends with the grain without splitting . . . much used in boat-building, light oars, staves, doors, window-sashes, etc., etc. . . . resists decay for a long time and is not attacked by insects" (65).

Authorities. Macoun (65), p. 36. Hough (49), pt. vi. p. 54. Laslett (60), p. 379. Anderson (2), p. 10. Mouillefert (79), p. 315. Boulger (12), p. 451. Sargent (100), p. 206.

Colour. "Deeper in colour than the Eastern Spruces": heart-wood orange brown: sap-wood yellowish-white" (49). "Very white and light: resembles White Pine" (2). It somewhat suggests a brown Pencil-Cedar when cut transversely. Heart-wood defined, but not abruptly, from the sap-wood.

Anatomical Characters. As those of the Piceas and Pines generally (see Nos. 242 and 235), but rays and pores readily visible when moistened. Tissue very dense and almost uniform. In tangential section the rays are visible as minute dots against the lustrous ground, being much darker, and are readily visible in the radial section, especially when moistened.

Type specimens authenticated by Hough.

No. 238. LARCH. Larix europea. DC. (not Michx.)

PLATE XVI. FIG. 137.

Natural Order. Coniferæ.

Alternative Names. Gemeine Laerche: Lorche: Lorcher Fichte: Gemeiner Lechenbaum: Terpintinbaum: Weisser Lorchen-baum: Europaische Ceder (113).

Sources of Supply. Northern Europe.

Physical Characters, etc. Recorded dry-weight 28½–41½ lbs. per cu. ft. Hardness Grade 7, compare Deal. Smell and taste none. Burns very well with a lively and rather noisy flame: greyish ash: some resin expelled by heat: little smell. Reaction with iron salts black.

Grain. Fine, smooth and exceptionally even. Surface rather lustrous and frosted.

Bark. Smooth, grey or yellowish when young: "later changing to a light red" (106).

Uses, etc. "Very durable" (106). "Durable in wet or dry . . . beams, house-building, water-pipes, wheelwrights' work, boats, mining timber, sleepers . . . tough: shrinks excessively and warps" (60 and 113). "It is accepted as imputrescible" (11). "Venice is reputed to be built on Larch piles" (60). "Very good paving blocks when from high altitudes . . . does not crack" (92). "The most valuable wood for all building purposes" (113). With a knife this wood cuts like hard cheese.

Authorities. Nördlinger (86), vol. iii. p. 10. Ditto (87). Schwartz (106), p. 477. Stevenson (113). Boppe (11), p. 90. Laslett (60), p. 344. Petsche (92), p. 107. Westermeier (129), p. 46. Schlich (104). Mathieu (69), p. 560. Wiesner (131), L. 6, p. 149.

Larch is often confused with other Coniferous woods.

Colour. Heart-wood reddish-brown or purplish-red. "Brownish-red even when fresh" (106). "Yellowish-white" (60 and 92). Sap-wood defined from the heart, white to yellowish: "6–20 rings wide" (106).

Anatomical Characters. Transverse section :—

Pores or *Resin-canals.* Abundant: need lens: "visible to the naked eye" (69). More often in pairs and threes than in the Pines: size 4: not infrequently attached to the Spring side of the Autumn boundary: few, about 22 per inch of arc: chiefly in the Autumn wood, but sometimes in the Spring: inconspicuous in the solid: bleed when cut, and then appear as resin-globules even upon a rough saw-cut surface.

Rays. Need lens, size 5–6: numerous, 7–10 per mm.: white: difficult to see in the solid: taper considerably and seem to alter in size at the ring-boundaries.

Rings. Very clear, prominent and sharply contrasted between the Spring, and the resinous and darker Autumn, wood: sharply separated from each other in the same ring: contour gently undulating. Horizontal resin-canals (see Rays).

Pith. About 1·0 mm. wide: red: angular.

Radial Section. A trifle darker. Pores locally numerous: difficult to see unless soiled. Rays visible, but inconspicuous, brown lines. Rings very prominent, but not so much contrast in colour as in the Pines.

Tangential Section. As the Radial, but the rays appear as minute lines about 0·3 mm. high, with a single round globule of dark resin in the centre of each: these bleed and become dusky specks. Rings appear as smooth-edged loops.

Type specimens from commercial sources and from trees known before felling.

Wiesner (131), p. 149, gives details of the microscopic structure of this wood, with a "key" (after Burgerstein) arranged for the purpose of distinguishing it from the wood of the Fir. He also states that the wood consists entirely of tracheids without any woody parenchyma.

No. 239. TAMARACK. Larix americana. Michx.

PLATE XVI. FIG. 137.

Natural Order. Coniferæ.

Synonyms. Pinus pendula, Ait. Abies pendula, Poir, etc.

Alternative Names. Black Larch: American Larch: Hackmatack (49). Épinette rouge (108). Red Spruce (95).

Sources of Supply. United States and Canada.

Physical Characters, etc. Recorded dry-weight, 35–42½ lbs. per cu. ft. I have no other details, as I do not possess a solid specimen.

Grain. Fine. Surface not very lustrous: slightly satiny.

Bark. "Of a bluish-grey colour . . . flakes off when old in small roundish scales" (49).

Uses, etc. "Very strong: railway-ties, fence-posts, telegraph poles and knees for ships and shipbuilding generally . . . is capable of supporting a great weight" (65). "Strong, compact and durable . . . one of the best timbers for railway-ties . . . a favourite wood for shipbuilding" (49). "It has given good results as paving material in Canada" (108). "Very strong, durable in contact with the soil" (100). "Cannot be surpassed for knees, bends and garlands for shipbuilding" (95).

Authorities. Robb (95). Macoun (65), p. 38. Ditto (66), p. 485. Hough (49), pt. i. p. 72. Laslett (60), p. 37 . Petsche (108). Sargent (100), p. 215. Pinus contorta is spoken of by Petsche as "Tamarack or Hackmatack."

Colour. "Light brown with lighter sap-wood" (49). "Reddish-grey" (60). "Light brown: the sap-wood nearly white" (3). Heart very irregular in contour.

Anatomical Characters. As those of L. europea, No. 238.

Rays. Readily visible in Radial section in certain lights.

Pores or vertical resin-canals readily visible as brown lines: prominent in Tangential section. Autumn wood rather sharply defined from Spring wood.

The above details have been obtained from a section by Hough.

No. 240. WESTERN WHITE FIR. Abies grandis. Lindl.

PLATE XVI. FIG. 136.

Natural Order. Coniferæ.

Synonyms. A. Gordoniana, Carr. A. amabilis, Murray. Pinus grandis, Dougl. Picea grandis, Loudon.

Alternative Names. Balsam (100). Balsam Fir (2). Great Silver Fir (49).

Sources of Supply. Canada and the United States.

Physical Characters, etc. Recorded dry-weight 22–29 lbs. per cu. ft. Hardness Grade 7, compare Deal. Smell or taste none. Burns well and quietly without crackling: aroma faint but agreeable: embers glow brightly in still air. Solution colourless.

Grain. Fine and even. Surface has a frosted lustre.

Bark. "When young is thickly covered with large bladders or cells filled with a liquid, resinous gum" (2). "Dark brown: fissured lengthwise, with quite regular, firm ridges which break away" (49).

Uses, etc. "Common . . . grows to a large size . . . held in small esteem, being perishable and brittle" (2). "Not suited for any purpose for which strength is required . . . boxes, light barrels, etc." (65).

Authorities. Anderson (2), p. 12. Macoun (65), p. 38. Sargent (100), p. 212. Hough (49), pt. ix, p. 51.

Colour. Brownish-white. "White" (2).

Anatomical Characters. As those of the Pines and Spruces generally (see Nos. 242 and 235), but without vertical resin-pores.

Rays. Need lens and are difficult to see even with the microscope in the solid wood in Tangential section, but in Radial section they are readily visible to the naked eye as a pale inconspicuous silver grain.

The Spring wood passes over into that of the Autumn very gradually, and the contrast between the two zones is not very great except at the extreme boundary. The Spring wood appears as a narrow zone only, and in wide rings the Summer and Autumn wood account for the extra width.

Type specimens authenticated by Hough.

No. 241. OREGON PINE. Pseudotsuga Douglasii. Carr.

PLATE XVI. FIG. 138.

Natural Order. Coniferæ.

Synonyms. Abies Douglasii, Lindl. A. taxifolia, Poir. Picea Douglasii, Link. Pinus Douglasii, Sabine, also Lamb. Pinus taxifolia, Lamb. Tsuga Douglasii, Carr.

OREGON PINE

Alternative Names. Douglas Pine, Fir or Spruce. Yellow or Red Fir in United States of America (11). Red Fir and Red Pine in Canada (12). Yellow Pine of Puget Sound (92).

Sources of Supply. Canada, British Columbia, United States of America.

Physical Characters, etc. Recorded dry-weight 30½–38 lbs. per cu. ft. (131). Hardness Grade 7, compare Deal. Smell faint if any. Taste peculiar and flat : not vinous like Pinus Australis (Pitch Pine). Burns well with a lively noisy flame : embers soon die out in still air and leave a carbonized stick : strong tarry smell. Solution almost if not quite colourless.

Grain. Even, smooth, close, the pores being filled. Surface partly of a resinous lustre and partly dull, in alternate bands.

Bark. "Dark grey, rough, with thick firm ridges arranged in a latticed manner : contains pitch-galls when young" (49).

Uses, etc. "A tree from 200–300 ft. high by 27–120 inches in diameter . . . wood strong, varying greatly : difficult to work : durable. The two varieties, Red and Yellow, distinguished by the lumbermen are probably dependent upon the age of the tree, the former coarse-grained, darker coloured and considerably less valuable than the Yellow Fir" (100). "Spars, flooring, works of construction, sleepers, piles, bridges, ships. Subject to the attacks of the teredo . . . durable when buried" (2). "Ship-building, bridge work, wharves, fencing, furniture" (65). "Good, but not equal to Pitch Pine for paving" (92).

Authorities. Nördlinger (86), vol. v. p. 9. Laslett (60), p. 375. Hough (49), vol. vi. p. 55. Petsch (92), p. 106. Anderson (2), p. 9. Macoun (66). Ditto (65). Wiesner (131), p. 152. Sargent (100).

Colour. Bands of a resinous-brown colour, alternating with lighter brown bands. "Splint yellowish" (86). Much lighter than the heart-wood.

Anatomical Characters. Transverse section. (Compare No. 242.)

Pores. Present as resin ducts : small, size 4 : few, very thinly scattered in the Summer and Autumn wood : imperfectly lined with soft-walled cells : uniform : bleed at the cut end after a time : absent over long stretches of the ring : clustered, single or paired.

Rays. Just visible, size 5–6, or rather more : 3–9 per mm. : denser than the ground : yellowish : long, tapering at length : interrupted by or running round the ducts : large ones frequent, long and bold, occasionally as large as size 5.

Rings. Very clear and prominent : the Summer and Autumn wood sharply separated with much contrast between them. Autumn wood very resinous and dense, always a band and sometimes very broad : contour undulating.

Ground-tissue. Spongy and coarse: cells diminishing outwards considerably and becoming opaque and filled with resin, in regular radial rows: very irregular in size between one row and another of the same ring.

Pith. ?

Horizontal Resin Ducts. Abundant on the limit of vision, but as they bleed and stain the adjoining wood they become readily visible specks in Tangential section.

Radial Section. Much lighter in shade than the transverse. Ducts appear as long, smeary lines. Rays scarcely prominent, but clear for a Conifer: brown, narrow and distinct. Rings (see *Colour*).

Tangential Section. As the Radial, but the smeary ducts are a feature. Rays need microscope, and are easily confused with oblique sections of the ducts: brown, blunt lines about 0·2 mm. high. Rings sharply defined loops: the Spring zones are of a peculiar hoary appearance, scarcely if at all frosted: covered with stains and small spots both in the Spring and Autumn wood. (Plate XXII. Fig. 177.)

Type specimens from commercial sources; also authenticated by Hough.

No. 242. DEAL. Pinus sylvestris. Linn.

(Not of Baume., Gouau., Herb., Lour., Mill., or Thunb.)

PLATE XVI. FIG. 137.

Natural Order. Coniferæ.

Sources of Supply. Northern Europe, Asia and America.

Alternative Names. Scotch Pine, Scots Fir, Red or Yellow Deal. Red, Yellow, Riga, Memel, Danzig, Stettin, Swedish, Norway, Polish, etc., Fir: Northern Pine. Red-wood, White-wood (60). Pin sylvestre, Sapin rouge du Nord, Bois rouge du Nord (92). Wild Pine (48). Pin de Hagenau: Pin à mature (70). Pin sauvage, Pin d'Écosse (113). Pin de Genève, P. d'Auvergne, P. blanc d'Autriche (92). Gemeine Kiefer, Fohre, Forle, Forche (123). Kiehne, Weiss-Kiefer (129).

Physical Characters, etc. Recorded dry-weight 19¼–52 lbs. per cu. ft. Hardness Grade 7, compare Birch, or rather softer. Smell characteristic (dealy). Taste flat. Burns very well with a lively crackling flame and a tarry smell: embers glow in still air: ash dark-coloured: usually brown. Solution pale.

Grain. Smooth, even, coarse in appearance, but the pores are very inconspicuous unless soiled. Surface lustrous, the Spring wood appearing crystalline under the lens, the Autumn wood of a resinous lustre.

Uses, etc. Almost too well known to mention. "Durable:

splits well" (106). "Good for paving" (92). "Durable both in water and in the ground" (129).

Bark. When young, parchment-like, of light yellowish-brown scales: later, very thick, red brown, deeply fissured, scaly (106).

Authorities. Nördlinger (86), vol. iii. p. 12. Schwartz (106), p. 477. Laslett (60), p. 313. Stevenson (113), p. 154. Boppe (11), p. 92. Petsche (92), p. 77. De Mornay (70), p. 115. Westermeier (129), p. 40. Mathieu (69), p. 588. Wiesner (131), L. 6, p. 153.

Colour. Heart reddish and resin-coloured, well defined from the whitish sap-wood. "Honey-coloured to reddish-brown" (104). "Sap-wood 27–80 rings wide. The colour of the heart appears after exposure to the air" (131).

Anatomical Characters. Transverse section:—

Pores. Present as resin-canals: rather large: on the limit of vision: lighter than the ground, but contrasting little: not white-looking: few: often double the size of those of the Spruce. "Usually very clear" (131).

Rays. Just visible from their lighter colour: light brown: apparently two sizes: one rowed and many rowed, a considerable number of the latter, but fewer than in the Spruce: taper rapidly.

Rings. Very clear and prominent, often conspicuous: the Autumn wood much denser, but merging gradually into that of the Spring: a sharp contrast at the boundary.

Ground-tissue. Very coarse: the cells gradually diminishing in size towards the outer side of the ring: in radial rows, which vary amongst themselves.

Horizontal Resin Pores. In the many-rowed rays, and difficult to find: just visible with the lens: crimson.

Pith. Brown, about 1 mm. diameter, round, radiating: of large, coarse, round cells.

Radial Section. Much lighter in shade than the transverse section. Pores not easily seen except when soiled, though large: their resinous contents collect the dust. Rays readily visible from the play of light only. Ground-tissue satiny and crystalline. Rays (see Horizontal Resin Pores).

Type specimens from commercial sources. It is difficult to put the differences between this wood and that of the Spruce upon paper, but perhaps the more abundant resin, the larger pores and scarcer large rays may afford clues.

Microscopically a distinction may be made. The bordered pits upon the walls of the cells of the tracheids of the rays adjoining those of the wood are the height of the former by the width of the latter: shortly, they are as large as the surfaces in contact allow. In the Spruce they are much smaller, and there may be several within the same limits.

No. 243. WHITE PINE. Pinus Strobus. Linn.

(Not of Buch., or Thb.)

PLATE XVI. FIG. 137.

Natural Order. Coniferæ.

Alternative Names. Weymouth Pine. Yellow Pine (60). American White Pine. New England, Pumpkin, Apple or Sapling Pine (113). Pin du Lord (69). Pin blanc, Pin du Nord, Weymouths-kiefer (129). Hough calls this tree Wehmuths-kiefer, i.e. Melancholy Pine, which seems a much more probable derivation than that the tree was named after Lord Weymouth.

Sources of Supply. North America, United States, Canada, Newfoundland and Nova Scotia. Cultivated in Europe and elsewhere.

Boulger gives the names of *Pitch, Hard* or *Norway* Pine as being in use in Nova Scotia for this species. I suspect an error here as the adjectives are not appropriate to this wood.

Physical Characters, etc. Recorded dry-weight, 20–30 lbs. per cu. ft. Hardness Grade 8, one of the softest woods. Smell "dealy" if any. Taste terebinthine, as strong as that of Pitch Pine. Burns very well with a tarry, piquant smell and a lively vigorous flame: embers glow in still air: ash grey or white. Solution colourless.

Grain. Fine, even and smooth. Surface smooth, brilliantly lustrous: crystalline when magnified.

Bark. "For a long time smooth, with a reddish lustrous appearance" (106). When old 1–1½ inches thick, flaking in scales which are clearly marked off in section: deeply fissured, rugged, of a chocolate-brown colour: an inner lighter-coloured layer about $\frac{1}{16}$ inch thick.

Uses, etc. Similar to those of the Common Spruce in England. "Shrinks or swells but little" (49). "Has not much durability as paving blocks" (92). "Very fissile: moderately elastic and durable" (129). The common and most valuable building timber in the United States: not strong, easily worked. The European-grown wood "is not to be recommended: lacks elasticity and durability: warps badly" (69)

Authorities. Nördlinger (86), vol. iii. p. 12. Schwartz (106), p. 478. Laslett (60), p. 256. Stevenson (113), p. 171. Hough (49), pt. ii. p. 41. Macoun (66), p. 464. Westermeier (129), p. 44. Mathieu (69), p. 629. Sargent (100), No. 347. Wiesner (131), p. 147.

Colour. Delicate pinkish-brown with a thin brown, white or yellowish sap-wood. Heart-wood excentric. "Often mottled" (gewassert) (86). "Orange to sienna" (104). "Reddish-yellow to bluish-red" (86).

Anatomical Characters. Very similar to those of the Pines generally (see No. 242). Transverse section much darker than the vertical sections, unusually so.

Pores. Present as resin-canals, rather small, size 4, but visible to the naked eye: chiefly in the Summer or middle zone of the ring: often in threes: appear white against the reddish colour of the wood (when cleanly cut).

Rays. Just visible, size 5 or rather less: numerous, 9-14 per mm.: denser than the ground: tough and separable as threads from a thin section: white, rarely brown.

Rings. Little contrast between the Spring and Autumn zones, the latter not very resinous, if at all, and not much darker in colour: contour well rounded. The ring-boundaries are barely perceptible on a Radial, and even less so on a Tangential, section.

Pith. From 1-3 mm. wide: red, grey or brown: soft: of "fine, thin-walled cells" (86).

Type specimens from commercial sources; also authenticated by Hough.

Wiesner makes the following distinction between this wood and that of Pinus sylvestris:—the contour of the inner side of the thickened cell-walls of the rays is even or gently undulating, while that of the Pine is ragged or toothed.

No. 244. PITCH PINE. Pinus palustris. Mill.

PLATE XVI. FIG. 138.

Natural Order. Coniferæ.

Synonyms. Pinus australis, Mich., not of Dun. or Hort.

Sources of Supply. The southern parts of the United States of America, chiefly upon the "Pine barrens" (49). Introduced elsewhere, and attains a considerable size in England.

Alternative Names. Long-leaved Pine, Long-leaved Yellow Pine, Yellow Pine, Broom Pine, Southern Pine, Hard Pine, Georgia Pine (49). Red Pine, Brown Pine, Swamp Pine. Pensacola Pitch Pine and similar names derived from the port from whence it is shipped. Turpentine tree of the South (60). Pek Den at the Cape of Good Hope (51). Gelb-kiefer (131).

Physical Characters, etc. Recorded dry-weight 37-43¾ lbs. per cu. ft. Hardness Grade 3, compare Blackthorn. Smell terebinthine, often strong. Taste strong, terebinthine, even vinous. Burns well with a lively, noisy, smoky flame and resinous smell: heat expels resin: embers glow in still air: ash brown. Solution colourless, but smells of the wood.

Grain. Fine, smooth, even: pores all filled: compact. Surface resinous rather than bright: rays dull: ground-tissue dully crystalline.

Pin Maritime, Pinaster, Pin de Bordeaux, Pin de Landes (129). Gewoon Den : Mannetje Danne Boom in South Africa (51).

Physical Characters, etc. Recorded dry-weight 33-48 lbs. per cu. ft. Hardness Grade 6, compare Beech Smell none when dry, but terebinthine when green or when worked. Taste flat if any. Burns well without smell, embers glow in still air, a brown resin expelled by the heat. "Very inflammable" (129). Solution quite colourless.

Grain. Very smooth, fine and even. Surface easily soiled : slightly frosted : the Autumn bands shiny.

Uses, etc. "Naval work, carpentry, pit-props . . . of little value" (129). "A wood of medium quality" (69).

Authorities. Hutchins (51). Westermeier (129), p. 42. Mathieu (69).

Bark. Dark-reddish violet : composed of large scales like the Scots Fir, but more deeply fissured.

Colour. White, whitish-brown to reddish-brown, with darker resinous zones in alternate bands.

Anatomical Characters. As those of Pinus sylvestris, No. 242, which should be compared. The following trifling variations may be constant. Transverse section :—

Rays. Scarcely visible, size 5-6 or rather more : numerous, 7-10 per mm. : large or many-rowed rays rare.

Horizontal Resin-canals, i.e. the larger rays, brown, spindle-shaped, visible with lens.

Radial Section. Rays readily distinguishable, prominent when the wood is cleft : brownish, rather dull flakes. Rings exceptionally bold : a striking contrast between Spring and Autumn wood, but the Autumn fades into the Summer wood.

Tangential Section. As the Radial, but the rays are minute lines readily distinguishable with lens. Rings bold loops without fringes, but less contrast of colour than one would expect from the Transverse section.

Type specimens from commercial sources and from trees known before felling.

No. 246. STONE PINE. Pinus Pinea. Linn.

(Not Gord., or Habl.)

PLATE XVI. FIG. 137.

Natural Order. Coniferæ.

Alternative Names. Umbrella Pine. Italian Stone Pine (60). White, Black or Mountain Pine and Double Spruce in Nova Scotia (12). Pignon, Pin bon, Pin de Pierre, Pin franc (Gironde et Landes) in France (69). Pin Pinier also (92). Pinie in Germany ?

Sources of Supply. Europe in the Mediterranean Region. Cultivated in many lands.

Physical Characters, etc. Recorded dry-weight 26–48½ lbs. per cu. ft. Hardness Grade 7, compare Birch. Smell none when dry: terebinthine when green. Taste flat. Burns very well without smell, a lively flame: embers glow in still air. Solution colourless or nearly so.

Grain. Smooth, even and fine. Surface slightly frosted, easily soiled.

Bark. "Like that of the Scots Fir, fissured: formed of thin whitish layers which separate in the form of scales. An inner layer becomes transformed into hard dry cork of a clear ochreous-red colour" (69).

Uses, etc. "Packing-cases, fuel, carpentry" (60). Pit-props. Usually confused with the wood of Pinus pinaster, the Cluster Pine and also with many other Coniferous woods.

Authorities. Nördlinger (86), vol. iii. p. 12. Laslett (60), p. 349. Petsche (92), p. 109. Mathieu (69), p. 622.

Colour and *Anatomical Characters* practically identical with those of Pinus Pinaster, which should be compared (see No. 245).

Type specimens from commercial sources and from trees known before felling.

No. 247. SUGAR PINE. Pinus Lambertiana. Dougl.

PLATE XVI. FIG. 138.

Natural Order. Coniferæ.

Synonyms. P. albicaulis, Eng. P. flexilis, Lyall. P. flexilis, var. albicaulis, Eng.

Sources of Supply. United States, British Columbia.

Alternative Names. North Carolina Pine. Great Sugar Pine (12). Columbian Pine (Sinclair). White-barked Pine (66). White, Soft or Pumpkin Pine: Pin gigantesque, Resin-kiefer (15).

Physical Characters, etc. Recorded dry-weight 23–51 lbs. per cu. ft. Hardness Grade 7, compare English Alder. Taste astringent and insipid, not terebinthine or vinous. Burns well with little or no smell, heat expels resin: embers glow in still air: ash grey. Solution pale straw: white ppt. upon the addition of potash.

Grain. Coarse, but the pores though open are not numerous. Surface dull.

Bark. "Of a dark-grey colour: rough, with rather firm longitudinal ridges resembling that of the White Pine (P. strobus)" (49).

Uses, etc. Similar to those of the Pitch Pine. May be met

with in the form of "logs, planks and boards from 10–20 ft. long by 10–20 in. broad" (109). The tree "attains a height of 300 ft. Building timber: is the most highly valued of the woods of California for doors, sashes, blinds, etc." (49).

Authorities. Hough (49), vol. vi. p. 51. Macoun (66), p. 465. Boulger (15), p. 290.

Boulger says that the wood much resembles that of the White Pine (P. strobus), but I imagine that he must mean the bark, as the wood is not likely to be mistaken for that species.

Colour. Honey-coloured and yellowish-white in stripes. "A delicate pinkish-brown with yellowish-white sap-wood" (49).

Anatomical Characters. As those of Pinus sylvestris, No. 242, but the pores or resin-ducts are visible to good sight in the Autumn wood and lighter in colour, while darker than the wood of the Spring: large, size oo: sometimes bleed.

Rays. The larger few, just visible. The rings nearly as prominent as those of the Pitch Pine (P. australis), No. 244, in Transverse section, and the Autumn and Spring zones as sharply defined.

Vertical Sections. Pores prominent and numerous. Horizontal resin-ducts in Tangential section just visible to good sight as fine specks: do not bleed. Rings about as prominent as those of Red Deal, but less so than those of the Pitch Pine. Compare also No. 238.

Type specimen sent me by Mr. Sinclair; no doubt this species.

SCALE OF MEASUREMENT

Grades of Hardness.

1. Excessively hard.	Lignum-vitae, Ebony.
2. Extremely hard.	Boxwood, Lilac, Jarrah, Karri, Blue gum.
3. Very hard.	Whitethorn, Blackthorn, Persimmon.
4. Hard.	Hornbeam, Elder, Yew, Laburnum.
5. Rather hard.	Ash, Holly, Plum, Common Elm.
6. Firm.	Teak, Chestnut, Beech, Walnut, Apple, Oak.
7. Soft.	Willow, Deal, Horse Chestnut, Alder, Australian Red Cedar, Birch, Hazel, English Cherry, Canary Whitewood.
8. Very soft.	White Pine (American), Poplar, Lime, Sequoia.

NOTE.—The abundance of examples in some cases and the paucity in others is owing to the desire to keep the types within the scope of the list of species dealt with in the descriptive part of the book. It would be useless to give such as are difficult to procure. Those given between brackets are put in for the sake of completeness, but neither the sizes nor the examples are employed here.

APPENDIX A

APPENDIX A

Apparatus for Measuring the Amount of the Resistance to Impact.

A square iron frame having a diagonal bar running across it is fixed upon a pillar of sufficient rigidity to resist vibration. A clamp to hold the test piece of wood slides upon the diagonal bar, and is made adjustable by means of three screws so that the cross (transverse) section of the wood can be brought precisely to an angle of 45° to the vertical. The diagonal bar is graduated to permit of a movement through a definite space. At a distance of one metre above the wood a small funnel is fixed through which a small steel ball weighing 10 grammes can be dropped upon the wood. At the side of the frame is a strip of brass which is fixed just 25 cm. from the point struck by the ball and a piece of squared paper marked at a point cut by a horizontal line drawn from the striking point (for zero) is placed upon it. Over this a type-writer ribbon is lightly stretched. The ball rebounding from the surface of the wood will strike the ribbon and leave a blue spot upon the paper at a point which will vary according to the amount of force absorbed by the wood. The harder the wood the nearer the mark will be to the horizontal, and on the contrary the trajectory of the ball will sink in proportion to the softness of the wood. As the zones of the annual rings will vary in their resistance, it will be necessary to slide the clamp for a short distance (say 5 mm.) for a series of (say ten) shots; this will give a fair average for the alternating hard and soft parts of any wood.

It will be seen that providing the conditions are complied with, similar results may be obtained by different observers, as nothing will depend upon their personal idiosyncrasies.

In addition to the apparatus described above, a small spirit level of the kind used by photographers fixed in one of the short sides of a right-angled triangular prism is needed in order to adjust the surface of the wood to the proper angle, and a small plummet to be suspended from within the tube of the funnel is requisite to insure the latter being exactly over the desired point upon the surface of the wood.

APPENDIX B

APPENDIX B

Apparatus for Measuring the Absorption of Water by a given Area of any Surface of a Piece of Wood.

A piece of round tool-steel is bored with a hole having a transverse area of 1 cm. One end is bevelled to a cutting edge and the other screwed to take a cap within which is an indiarubber washer. The cap is provided with a hole through which a graduated pipette can be passed. The pipette is inserted through a small hole in the rubber washer thus making a water-tight joint. The rubber washer also serves to make the cap water-tight with the steel body.

To apply the apparatus, drive the sharp end of the body into the surface of the wood to be examined, fill it with water and cover with the washer and cap. Insert the pointed end of the pipette through the holes in the cap and washer and allow the water to rise in the glass tube until it reaches zero, and note the time. The water will rise in the tube because it is displaced by the glass tube, which forces it out of the body. At first a rapid sinking takes place as the water fills the ruptured pores upon the surface of the wood. This soon slows off and the natural pace of absorption is soon reached. For this reason it is useful to watch the fall of the level of the water in the pipette carefully for a quarter of an hour, otherwise a false impression will be obtained. Do not allow the steel to remain longer in the wood than is absolutely necessary, for if tannin be present the cutting edge will rapidly perish.

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INDEX

INDEX

Abies alba, 265.
  Albertiana, 264
  amabilis, 270
  canadensis, 265
  Douglasii, 270
  excelsa, 264
  Gordoniana, 270
  grandis, 270
  Menziesii, 266
  Pattoni, 264
  pendula, 269
  Picea, 264
  sitchensis, 266
  taxifolia, 270
Acacia xxxvi, and 59
  acuminata, xvi and 77
  Angico, 72
  False, 59
  harpophylla, 80
  homolophylla, 79
  juniperina, xxii
  melanoxylon, 81
  odoratissima, 73
  pendula, 78
  Raspberry-scented, 77
Acajou, 36
  amer., 36
  à Meubles, 34
  blanc, 27
  Cedre, 36
  femelle, 36
Acapu, 93
  -rajada, 91
Acer barbatum, 55
  circinatum, 57
  dasycarpum, 55
  macrophyllum, 57
  nigrum, 55
  palmifolium, 55
  Pseudo-Platanus, 54
  saccharinum, 55
  virgatum, 57
Æsculus Castanea, 51
  hippocastanum, 51
  memmingeri, 51
  procera, 51
Africa, 21, 61
  North, 208, 230
  South, 3, 4, 26, 43, 45, 47, 48, 53, 81, 90, 102, 109, 117, 134, 138, 147, 148, 157, 164, 165, 172, 173, 193, 200, 228, 253, 254, 255, 257, 277
  Tropical, 10, 38, 74, 153
  West, 61, 69, 95
Afzelia rhomboidea, 88
Agathis australis, 202
  robusta, 202
Age indicated by annual rings, xiv
Albizzia Lebbek, 74
  odoratissima, 72
Alder, 217, 219
  black, 217
  Common, 217
  Oregon, 219
  Red, 219
  Red (Cape), 109
  Western, 219
Algarroba, 100
Alnus communis, 217
  glutinosa, 217, 219
  oregona, 219
  rubra, 219
Alpes, 265
Aludel, 204
Amarante, 84
Amarilla yema de huevo, 169
Amazonas Region, 19, 27, 46, 88, 94, 100, 176, 202, 203
Ambon, 70
America, 21, 228, 231
  Central, 66, 68
  North, 51, 59, 105, 106, 108, 146, 149, 161, 197, 210, 215,

INDEX

America, North (*continued*)—
    226, 227, 228, 230, 238, 256, 261, 274
  Tropical, 18, 38, 46, 93, 94, 97, 100, 135, 136, 168, 176, 202, 203
  South, 36
Amerimnon Ebenus, 96
Amerimnum Ebenus, 96
Anacardiaceæ, 58
Andaia-uichi, 92
Andamans, 10, 75
Andara-Uichi, 92
Andira, 91
  acuminata, 93
  amazonum, 92
  Aubletti, 92
  excelsa, 92
  grandiflora, 93
  inermis, 92, 93
  racemosa, 92
  retusa, 92
  stipulacea, 92
Andiroba branca, 38
  carapa, 38
Angelim, 93
  de Para, 92
Angelin, 91
Angelion de Para, 92
Angica de Sertao, 72
  vermelha, 72
Angico, 72
Angsanah, 75
Annual rings, xi, xii, xiii, xiv
Anonaceæ, 1
Apatite, xx
Apocynaceæ, 164
Apodytes acutifolia, 43
  dimidiata, 43
Apple, 104
  Wild, 104
Arbor-vitæ, 260
  Giant, 260
  Pacific, 260
Arbutus Menziesii, 146
Arctostaphylos glauca, 145
  Hookeri, 145
  Manzanita, 145
  pungens, 145
Artocarpus heterophylla, 206
  integrifolia, 205
  Jaca, 206
  maxima, 206
  nobilis, 204
  pubescens, 204, 206
Aruba, 27
Ash, xii, xxiv
Ash, American, 162, 163
  Arkansas, 163
  Australian Mountain, 14
  Bitter, 28
  Black, 161
  Black (Nova Scotia), 162
  Common, 160
  English, 160
  European, 9
  Green, 162
  Ground, 161
  Hoop, 161
  Hungarian, 160
  Mountain, xvii and 105
  Mountain (Australia), 124
  Mountain (Newfoundland), 162
  Nova Scotia, 161
  Quebec, 162
  Red, 162
  Swamp, 161
  United States, 162
  Water, 163
  White, 162
  White River, 162
Asia, 21, 70, 74, 103, 104, 105, 209, 215, 217, 222, 230, 256
Aspalathus Ebenus, 96
Assagay-boom, Beech-leaved, 138
Assegai-wood, 138
Atchoourgo, 132
Aune commune, 217
Australia, 40, 90, 110, 115, 125
  East, 189
  South, 80, 81, 214
  Western, 77, 114, 116, 117, 119, 120, 121, 126, 127, 128, 186, 187, 212
Autumn-wood, xii
Axemaster, 242
Azadirachta indica, 31

Baerentraube, Californische, 145
Bahama Lignum-vitae, 20
Bahamas, 20
Bainha de Espada, 88
Balata, 148
  des Galibis, 148
  rouge, 148
  saignant, 148
Bali, 70
Balsam, 270
Banksia, 187
  collina, 187
  integrifolia, 183
  littoralis, 187
  marginata, 183
  sea-side, 187

INDEX

Baphia nitida, 69
Barbadoes, 9, 10, 18, 21, 36, 100, 202, 206
Barberry (Canada), 49
Bark, xv
Barklak, 135
Barome, 148
Barueh, 148
Barwood, 69
Basswood, 11
Beech, ix, xv, xvi, xviii, xix, and 231
American, 231, 234
Australian White, 13
Cape, 147
Entire-leaved, 233
New Zealand, 233
Red, 234
St. John's, 231
Tooth-leaved, 232
White, 231
Bean, Black, 90
Red, 41
Tree, 90
Bearberry, 49
Bear-wood, 49
Beefwood, 189, 214
Gedraaid, 214
Bee Tree, 11
Beilschmiedia Tawa, 182
Benaroon, 124
Benthamia florida, 139
Berg-ahorn, 54
Beriba, 2
Bermuda, 169
Berria Ammonilla, 16
mollis, 16
Berrya, 16
Bethar, 132
Betula alba, 215
Alnus, 217
carpinifolia, 216
excelsa, 216
glutinosa, 217
lenta, 215, 216
nigra, 215, 216
pendula, 215
verrucosa, 215
Beukenhout, 147
Bibiru, 176
Bignoniaceæ, 169
Bilge-water Tree, 93
Billy-web, 97
Bilsted, 112
Birch, xvii and 215
American, xv and 216
Black, 215, 216
Birch, Black (Wellington, N.Z.), 233
Cherry, 216
Dwarf, 216
Mahogany, 216
Mountain, 216
(New Zealand), 232
Red (New Zealand), 232
River, 216
Russian, 215
Silver, xvi and 215
Sweet, 216
White (Nelson, N.Z.), 233
Yellow, 216
Bird's-eye Figure, xvii
Bitterash, 27, 28
Bitteresche, 27, 28
Bitterwood, 27
Bixineæ, 3–5
Blackbutt, xxvi and 124, 126
Blackheart, Brazil, 93
Blackwood, African, 61
Australian, 81
(S. Africa), 155
(S. India), 63
Blasois, 224
Blauholz, 68
Blutholz, 68
Bogabog-u-veto, 4
Bois blanc du Nord, 265
d'Acajou, 36
d'Acajou à Meubles, 34
de Cypre, 168
de Nicaragne, 68
de sang, 68
de Sappon, 70
Férole, 101
jaune, 202
Lezard, 203
rouge du Nord, 272
satiné, 101
Violet, 84
Bollitree, 148
Bombax malabaricum, xxix
Boniato amarillo, 178
Boragineae, 167
Boree, 78
Borneo, 170
Bouillard, 236
Bow-wood, 101
Boxwood, xv, xvi, xxii, xxvi, xxix, xxxvi and 192
Abassian, 20
Anatolian, 192
Australian, 123
Bastard, 125
Cape, 164, 193
Chinese, 194

INDEX

Boxwood, Circassian, 192
  Corsican, 192
  East London, 193
  East London (*Gonioma*), 164
  English, 192
  Knysna, 164
  Partheni, 192
  Persian, *192*
  Turkish, 192
  (U.S.A.), 140
  West Indian, xv and 169
Brasilholz, Gelbes, 202
Brazil, 9, 19, 23, 27, 28, 37, 38, 46, 62, 68, 72, 84, 88, 91, 93, 100, 136, 137, 148, 169, 176, 202, 203, 205
Braziletto, Narrow-leaved, 70
Break-axe, 242
Brigalow, 80
Brisbane, 37
British Columbia, 57, 228, 266, 271, 278
British Guiana. See Guiana
Broad-leaved Trees, xxxvii
Brosimum Aubletti, 203
Brya ebenus, 96
  leucoxylon, 96
Buchstabenholz, 203
Buckthorn, xxi
  (Canadian), 49
  Sacred-bark, 49
Buddleia salvifolia, 165
Buis commun, 192
Bukkum-wood, 70
Bullet-wood, xxi and 148
  Bastard, 45
Bully, Bastard, 46
  Tree, 148
Burma, 10, 17, 31, 37, 70, 73, 75, 151, 170
Burning, phenomena of, xxxv
Buro-Koro, 203
Burracurra, 203
Busserole de California, 145
Butter-wood, 207
Button-ball, 207
  -wood, 207
  -wood, Californian, 207
Buxus japonica, *192*
  Macowani, 193
  sempervirens, 192

Caban, 69
Cabbage-bark Tree, 93
Cabban, Bastard, 93
Cæsalpinia angustifolia, 70
  Sapang, 70
Cæsalpinia Sappan, 70
  Sappoa, 70
California, 228
Callitris, 258
Callus, xvii
Calodendron, 26
Calodendrum capense, 26
Calshum, *14*
Calycophyllum candidissimum, 144
Cambalholz, 69
Cambium, x, xxi
Campeachy-wood, 68
Campeche, 68
Campomanesia, 38
Camwood, 69
Canada, 1, 11, 49, 55, 57, 108, 109, 141, 146, 161, 162, 197, 198, 199, 207, 210, 216, 226, 227, 228, 231, 234, 238, 245, 246, 255, 257, 259, 260, 264, 266, 269, 270, 271, 274
Canari-Macaca, 136
Canary Wood, 1
Cangica, 72, 203
Canoe-wood, 1
Caoba, 33, 34
Cape Colony, 53, 81, 207, 214, 254
Caprifoliaceæ, 141
Caraba, 38
Carapa guianensis, 38
  guineensis, 38
  guyanensis, 38
  latifolia, 38
  procera, 38
Caribaballi, 38
Carib-wood, 38
Carpin, 219
Carpinus Betulus, 219
  italica, 222
  Ostrya, 221
  virginiana, 221
Carpy, 219
Carya, 211
Cascara sagrada, 49
Cassie, *98*
Cassine crocea, 47
Castanea, 230
  vesca, 230
  vulgaris, *230*
Castanospermum australe, 90
Casuarinas, xvi
Casuarineæ, xxxvii, xxi and pp. 212–214
Casuarina Fraseriana, 212
  lugubris, 214
  tenuissima, 214
  torulosa, 214

INDEX

Caviuna, 62
Cayenne, 28
Ceder, Europäischer (Larix), 267
Cedre Acajou, 36
  (Brazil), 36
  de Singapore, 37
Cedrela, 32, 35
  australis, 37
  febrifuga, 37
  hexandra, 37
  odorata, 36, 37
  serrata, 37
  Toona, 37
Cedro, 36
  aromatico, 36
  vermelho, 37
Cedar, xxxvii
Cedar, 36
  African, 33
  Barbadoes Bastard, 36
  Black, 177
  Canadian Red, 260
  Clanwilliam, 258
  Cuba, 36
  Giant, 260
  Havannah, 36
  Honduras, 36
  Jamacia, 36
  (Juniperus), 255
  Mexican, 33, 36
  Moulmein, 37
  (N.S.W.), 37
  North-Western Red, 260
  New Zealand, 260
  Panama, 33
  Pencil, xxvi, xxxiv, xxxvi, and 225
  Pencil (Australian), 40, 41
  Red (Australia), 37
  Red (Cape), 109
  Red (Juniperus), 255
  Red (Thuya), 260
  Tabasco, 33
  Virginian, 255
  Western Red, 257
  Western White, 260
  West Indian, 36
  White (Bermuda), 169
  Yellow, 257, 259
  Yellow (Thuya), 260
Ceanothus Chloroxylon, 50
Cego-machardo, 137
  Maschado, 137
Celastrineæ, 47, 48
Celastrus acuminatus, 48
Cells, xviii
Celtis Kraussiana, 200
Celtis rhamnifolia, 200
Cerasus serotina, 107
Cerillo, 50
Cerisier, 106
  à Fruits acides, 106
Ceylon, 10, 17, 29, 31, 65, 73, 204, 205
Chagne, 224
Chalanga da, 75
Chamæcyparis nutkaensis, 259
Charme, 219
  -houblon, 222
Charmelle, 219
Chêne à grappes, 224
  blanc, 224, 225
  femelle, 224
  mâle, 225
  noir, 224, 225
Cherry, American, 107
  Black, 108
  Canadian, 109
  English, 106
  Garden, 106
  Sour, 106
  Wild Black, 108
  Wild (Canada), 49
Chestnut, 230
  American, 230
  Edible, 230
  Horse, 51
  Moreton Bay, 90
  Spanish, 230
  Sweet, xxxv and 230
  Wild (S. Africa), 26
Chichipate, 96
Chile, 76
Chlorophora excelsa, 95
  tinctoria, 202
Chloroxylon Swietenia, 29
Christusdorn, 44
Cibicibi, 75
Ciroaballi, Brown, 180
  Dark, 180
  Yellow, 177
Citronnier, 23
Citrus aurantium, 21, 23
  limonum, 23
  medica var. limonum, 23
Claraiba, 168
Climbers, structure of, xxii
Cloncurry River, 80
Cochêne, 105
Cocoa-wood, 96
Cocobola Wood, 239
Cocos, 96
Cocus, 96
Coco-wood, 97

INDEX

Cogwood (Greenheart), 176
Jamaica, 50
(Windward Isles), 169
Compiègne, 225
Coniferæ, 244–277
Congoholz, 61
Conifers, xiv, xxxvii
Copaiba, 84
Copaifera, 84, 86, 87
Copaiva, 84
Copalm, 112
Cordia geraschcanthus, 168
gerascanthoides, 167
gerascanthus, 167
tinifolia, 167
Corkwood, x, 110
Cornaceæ, 138–141
Cornel, 139
Cornelian-wood, 140
Cornus florida, 139, 141
Nuttalli, 140
Coromandel, 29, 74
Corylus avellana, 223
Cotton-varay, 74
Cottonwood, 237
Big, 238
Coudrier noisetier, 223
Couramira, 46
Courbari, 99
Courbaril, 84, 99
Plum, 99
Cowdie, 262
Cowrie, 262
Crab, 104
Crababalli, 38
Crab-apple, 104
-tree, 104
Crabwood (Guiana), 38
Crocus Tree, 47
Cuba, 9, 36, 82, 93, 144, 169, 178, 202
Bois de, 202
Cunonia capensis, 109
Cupressus nutkaensis, 259
Cupuliferæ, xxxvii and 215–234
Curtisea fagifolia, 138
faginea, 138
Cuyas de Macaco, 136
Cypre, Bois de, 168
Cypress, 259
Cypresses, xxxvii
Yellow, 259

Dacamaballi, 93
Dacrydium cupressinum, 247
excelsum, 249
Westlandicum, 248
Dalbergia, xxxv and 61, 63, 64, 65, 66
javanica, 63
latifolia, 63
marginata, 63
nigra, 62
Dammara australis, 262
Dammar, Southern, 262
Damson, Bitter, 27
Mountain, 27
Danne Boom, Mannetje, 277
Date-plum, 149
Deal, xiv and 272
Danzig, 272
Memel, 272
Norway, 272
Polish, 272
Red, 272
Riga, 272
Stettin, 272
Swedish, 272
White, 264
Yellow, 272
Degame-wood, 21, 144
Del, 204
Den, Gewoon, 277
Deodar, 245
Dialamban, 61
Dimorphandra excelsa, 94
guianensis, 94
Mora, 94
Diospyros, 150
Dendo, 153
Ebenus, 151
exsculpta, 154
memanoxylon, xxviii and 154
tomentosa, 154
Tupru, 154
virginiana, 149
Wightiana, 154
Dipterocarpeæ, 6
Djeroeh besaar, 21
Bnnten, 21
djepan hetjiel, 21
hetjiel, 21
Djerook djepan sedang, 21
ragie, 21
Dogwood, 140, 141
Flowering, 140
Western Flowering, 141
Dominica, 88
Dottergelb, 169
Drillard, 225
Drille, 225
Drimys chilensis, xxii
Winteri, xxii
Duboisia myoporoides, 110

INDEX

Duguetia quitarensis, 2
Durelin, 225
Dye-woods, xxxii
Dysoxylon, 40, 41, 99
Dysoxylum Fraseranum, 40
  Muelleri, 41
  Spectabile, 42

East Indies, 17
Ebenaceæ, 149–155
Ebenholz, Blaues, 84
Eberesche, 105
Ebony, xv, xvi, xxv, xxvi, xxviii, xxxvi and 154
  American, 97
  Billet-wood, 153
  Black, 153
  Brown, 96
  Calabar, 153
  Gaboon, 153
  Green, 96
  Jamaica, 96
  Lagos, 153
  Macassar, 150
  Marble, 150
  Niger, 153
  Purple (Ceylon), 65
  Senegal, 61
  (Sierra Leone), 61
  West Indian, 96
Edeltanne, 265
Elæocarpus dentatus, 15
  grandis, 14, 16
  Hinau, 15
  Kirtoni, 13, 16
  longifolia, 14
Elæodendron croceum, 47, 29
Elder, 141
  (S. Africa), 166
Eller, 217
Elm, xii, xxi
  American, 197, 198
  Canada, 197
  Cliff, 198
  Common, 196
  Cork, 196, 198
  European, 196
  Nova Scotia, 197
  Red, 197
  Rock, xii and 198
  Spanish, 168
  Swamp, 197, 198
  Water, 197
  White, xii and 197, 198
  Yoke, 219
Else, 217
Els, Red, 109
Els, Rood, 109
Elze, 109
Elzenhout, Red, 109
Endogens, xxxvii
Eperu, 88
Eperua falcata, 88
Épicea, 265
Épi de Blé, 93
Épinette blanche, 266
  rouge, 269
Érable, Grand, 54
  sycomore, 54
Ericaceæ, 145, 146
Erle, Gemeine, 217
  Roth, 217
  Schwartz, 217
Esche, Europeesche, 160
Eucalypt, Fluted, 120
Eucalyptus, xv, xxvi, xxix
  calophylla, 117
  Collosea, 116
  floribunda, 114
  globulosus, 125
  globulus, 125
  gomocephala, 121
  hemilampra, 115
  hemiphloia, 123
  hypoleuca, 114
  incrassata, 124
  longicornis, 128
  loxophleba, 119
  Mahagoni, 114
  marginata, 114
  megacarpa, 125
  microcarpa, 128
  multiflora, 115
  obtusifolia, 126
  ornata, 124
  patens, 126
  persiciflora, 124
  pilularis, 124, 126
  resinifera, 115
  Salmon-barked, 127
  salmonophloia, 127
  salubris, 120
  semicorticata, 124
  tereticornis, 125
  versicolor, 116
  viminalis, 124
Eugenia cordata, 134
Euphorbiaceæ, 192–195
Europe, 21, 44, 51, 59, 103, 104, 105, 106, 141, 156, 160, 192, 208, 209, 215, 217, 219, 222, 223, 225, 226, 230, 231, 235, 236, 245, 256, 265, 267, 272, 277

INDEX

Fagara flava, 23
Fagarastrum, 24
Fagus ferruginea, 231, 234
  fusca, 232
  Solandri, 233
  sylvatica, 231, 234
  sylvestris, 234
Fau, 231
Fayard, 231
Feldulme, 196
Felt, xiii
Ferolier, 101
Ferolia guianense, 101
  variegata, 101
Fichte, 265
  Lorcher, 267
  Schimmel, 266
Fig, Blue, 14
Fiji, 75
Filbert, 223
Fir, 272
  Balsam, 270
  Douglas, 271
  Great Silver, 270
  Red, 271
  Scots, 272
  Spruce, 264
  Western White, 270
  White, 264
  Yellow, 271
Fisetholz, 202
Flecks, xvii
Flintwood, 124
Florida, 20
Fohre, 272
Fohre, See-, 276
Forche, 272
Foyard, 231
France, 219, 222, 235, 236, 265, 277
Fraxinus acuminata, 162
  americana, 162, 163
  canadensis, 162
  carolineana, 163
  epiptera, 162
  excelsior, 160, 163
  nigra, 161
  pallida, 163
  platycarpa, 163
  sambucifolia, 161
Fusanus, 158
  cygnorum, 190
  spicatum, 190
  spicatus, 190
Fustete, 202
Fustic, xxxii and 202
Fustick-wood, 202
Futeiba, 202

Gabanholz, 70
Gaillard Franc, 18
Gamelleira preta, 203
Gateado, 203
Gatia, 203
Geelhart, 176
Geelhout, 254
  Cape, 253
Geffroya racemosa, 92
Gelbholz, 202
Genebre, 256
Genevrier, 256
Geoffræa inermis, 93
Germany, 196, 222, 225, 256, 26
  277
Gidgee, 80
Gidia, 80
Gigantabies taxifolia, 261
Gimlet-wood, 120
Gironde, 224, 277
Glattrüster, 196
Gold Coast, 6
Gom-boom, Fraaiblad, 117
Gomme animée, 100
Gonioma Kamassi, 164
Granadillo, 96
Granillo, 96
Grani, xxxvi
Gravelin, 224
Greenheart, 176
  Yellow, 176
Grenadilla-wood, African, 61
Grevillea, 185
  robusta, 185
  umbratica, 185
  venusta, 185
Guadeloupe, 27, 101
Guaiacan, 19
Guaiacum, xxxii
  arboreum, 18
  bijugum, 18
  multijugum, 20
  officinale, 18, 20
  sanctum, 20
  verticale, 20
  -wood, 18
Guatteria quitarensis, 2
  virgata, 2
Guayaca, 19
Guayacan, 18, 19
Guiana, 28, 38, 46, 84, 88, 94, 10
  101, 135, 136, 143, 148, 17
  177, 178, 179, 180, 181, 20
Gum Trees (Australian), xxix
  Blue (Tasmania), 125
  California Red, 112
  Gimlet, xii and 120

Gum Trees, Grey, 125
Mahogany, 114
Morrell, 128
Red (Australian), 115
Red (Liquidambar), 112
Red (S.W. Australia), 117
Salmon, xv and 127
South American, 112
Star-leaved, 112
Sweet, 112
White, 116, 121
York, 119

Hackia, 142
Hackmatack, 269
Hæmatoxylon campechianum, 68
Hagbuche, 219
Hagebuche, 219
Hainbirke, 216
Hainbuche, 219
Hakea acicularis, 186
Halleria elliptica, 172
lucida, 172
Halmillilla, 17
Hamamelideæ, 112
Hangebuche, 231
Hardbeam, 219
Hardness of wood, xxv, 280
Hassagay-wood, 138
Hazel, 223
Heart-wood, x, xv
Hemlock, 264
Western, 264
Hibiscus elatus, 9
populneus, 10
Tall, 9
tiliaceus, 9
Hickory, xiv and 211
Himalayas, 104
Hinau, 15
Hoheria populnea, 8
Holder, Schwartze, 141
Holly, xxi and 44
Honeysuckle, Coast, 183
White, New Zealand, 183
Honduras, 36
Hoobooballi, xii and 98
Hoop Tree, 31
Hopfenbuche, 222
Hornbaum, 219
Horse Chestnut, xix, xxii, 51
Hornbeam, xv, xxix, 219
Hop, 221, 222
Houi, 7
Huelsdorn, 44
Huelsen, Gemeine, 44
Humiriaceæ, 46
Humiria arenaria, 46
elliptica, 46
floribunda, 46
laurina, 46
mutiflora, 46
parviflora, 46
surinamensis, 46
Humirium, 46
Hure mara, 73
Hurihi, 73
Hutu Tawhai, 232
Hymenæa aminifera, 90
Hymenæa Courbaril, 90
resinifera, 90

Ibiariba, 92
Igqwauxe, 157
Ilex aquifolium, 44
capensis, 45
Ilicineæ, 44, 45
I-Miuga, 172
India, 10, 17, 29, 31, 37, 63, 70, 73, 75, 81, 151, 154, 170, 191, 206, 245
Inga vera, 97
Ipreau, 196
Iroko, 95
Iron-bark, xvi, 115
Tree, 143
Ironwood, Black (S. Africa), 157
(Hackia), 143
(New Zealand), 130
(Ostrya), 221
(Quebracho), 242
Irtalie, 90
Isle de France, 70
Itauba-branca, 176
vermelho, 176
Ixora ferrea, 142
triflorum, 142

Jaack-wood, 205
Jacaranda, 62
Cabiuna, 62
preto, 62
Jaca-tree, 205
Jack Tree, 204
Jacqueira, 205
Jak-wood, 205
Jam, 77
Jamaica, 9, 27, 31, 36, 50, 97, 168, 178
Japan, 149
Japanholz, 70
Jarrah, xxvi, xxxv, 114
Jarrah, Curly, 114

Jarrah, Salmon-barked, 127
Jatai, 100
Jatoba, 100
Java, 46, 205
Jebaru-rana, 88
Jetahy, 99
accu, 99
Jimmy Low, 115
Juglandaceæ, 209–211
Juglans nigra, 210
regia, 209
Sieboldiana, 210
Juniper, 256
Californian, 257
Canadian, 257
Western, 257
Juniperus barbadensis, 255
communis, 256
excelsa, 257
occidentalis, 255, 257
virginiana, 255, 257

Kahikatea, 240
Kahikatoa, 249
Kakeralli, 135
Kamahi, 111
Kamai, 111
Kamassihout, 164
Kari, 116
Karri, 116
Kastanie, 26
Kastanje, Australische, 90
Europeesche, 230
Kaapsche, 230
Kaapje, 26
Katamanakku, 17
Katoenhout, 238
Kawhaka, 260
Kawri, 262
Kedgy-kedgy, 41
Keritee, 179
Khaya senegalensis, 32
Kiefer, Gemeine, 272
Resin, 278
Weiss, 272
Weymouths, 274
Kiehne, 272
Kiggelaria Dregeana, 3
glandulosa, 3
integrifolia, 3
Kirton-wood, 13
Klipdoorn, 5
Knightia excelsa, 183
Knob-hout, 25
Knobthorn, 24
Kohe-Kohe, 42
Kokkra-wood, 97
Koomkabang, 185
Koondeba, 214
Kooroobaili, 86
Kooroobooilli, 85, 86
Kooroobovilli, 84
Korbesche, 161
Kos, 205
Kowhai, 76
Kretti, xxxvi and 179
Kundi, 38
Kurpoora maram, 125
Kuthul, 205
K'wannarri, 100

Lace-bark, 7, 8
-wood, 208, 238
Laerche, Gemeine, 267
Lafie, 265
Lagos, 6, 33, 95
Laintlain, 6
Lancewood, Cape, 138
Cuba, 2
Degame, 144
Jamaica, 2, 144
Landes, 224, 277
Laranjeira doce, 21
Larch, 267
American, 269
Black, 269
Larix, americana, 269
europea, 267
Laurel, Madrona, 146
Laurus bullata, 173
Tama, 182
Tawa, 182
Léard, 236
Lechenbaum, Gemeiner, 267
Lecythis grandiflora, 136
Ollaria, 135
Leeward Islands, 203
Leguminoseæ, xxiii and 59–99
Lemon-wood, 22, 23
Lenticels, xvi
Leopard-wood, 203
Letter-wood, 203
Levant, 208
Lever-wood, 221
Liardier, 236
Libocedrus Bidwilli, 260
Doniana, 260
Liège, bois de, 9
Lightwood (N.S.W.), 81
Lignum citrinum, 202
Guaiaci, 20
-vitæ, xvi, xxvi, xxxvi and 18
(Cocus), 97

INDEX

Lignum-vitæ, Guayaquil, 243
(Hackia), 143
Maracaibo, 18
Lime Tree, 13
(Citrus), 23
(U.S.A.), 11
Limoeiro, 23
Limon, 23
manie, 21
Lin, 11
Linden (U.S.A.), 11
Liquidambar monophylla, 112
styraciflua, 112
Liriodendron tulipifera, 1
tulipiflora, 1
procera, 1
Litsea calicaris, 175
Locust, 59
Black, 59
Gum, 100
(Hymenœa), 99
Red, 59
Tree, Leathery-leaved, 100
West Indian, 100
Locustrier, 100
Locust Yellow, 59
Loganiaceæ, 165, 166
Log, surface of, xvi
Logwood, xxxii and 68
Lombricero, 93
Lophira africana, 6
alata, 6
simplex, 6
Lorche, 267
Lorchen-baum, Weisser, 267
Luftholz, 84
Lythrarieæ, 137

Macaco, Pao, 136
Maclura tinctoria, 202
Madeira, 105
Madras, 125
Madrona Laurel, 146
Madera, 146
Magnoliaceæ, 1
Maha Neem, 31
Mahoe, Blue, xxvi and 9
do Mer, 9
Mountain, 9
Mahogany, xxxiii, 33
African, xxiv and 32, 33
American, xxiv
Assinee, 33
Australian, 40, 114, 124
(Casuarina), 214
Red, 115
Axim, 33
Mahogany, Bermuda, 33
City St. Domingo, 33, 35
Cuba, 33, 35
East Indian, 241
Forest, 115
Honduras, xxiv, 33
Indian, 37
Lagos, 33
Laguna, 33
(Logwood), 68
Mountain (Betula), 216
Natal, 3
Panama, 33, 35
St. Domingo, xxiv, 33, 35
Tenasserim, 75
Tabasco, xxiv and 33
(West Australian), 117
Mahot, Grand, 9
Mai, 251
Maire, Black, 158
-rau-nui, 158
White, 159
Majagna, 9
Malabar, 63
Malacca, 37, 75, 205
Malay Archipelago, 31, 151, 19?, 206
Malus communis, 104
Malvaceæ, 7-10
Mamin, 37
Manao, 248
Mangeao, 175
Mangeas, 175
Manzanita, 145
Maple, xvii, xxix
Big-leaved, 57
Bird's-eye, 55
Broad-leaved, 57
Californian, 57
Hard, 55
Oregon, 57
Rock, 55
Russian, 215
Sugar, 55
Vine, 57
Maracaibo, 19
Marara, 110
Marawagana, 84
Marawayana, 84
Marawinaroo, 84
Margose, 29
Marmites de Singe, 136
Marronier d'Inde, 51
Marsaule, 235
Marsault, 235
Maruba, 27
Mastbuche, 231

INDEX

Matai, 251
Maubo do Mato, 9
Melia, 32
  australasica, 31
  Azadirachta, 31
  dubia, 31
  Indica, 31
Meliaceæ, 29–42
Melaleuca leucadendron, 132
  var. Cunninghami, 134
Melkhout, 148
Merisier (Betula), 216
Metrosideros lucida, 130
  robusta, 129
  tomentosa, 131
Meui, 6
Mexico, 34, 36, 112, 146, 207, 228
  255
Microscope for wood, xxxiii
Milk-wood Tree, 132
Millai, 6
Mimosa guianensis, 98
  odoratissima, 73
  serissa, 74
  Sweet-scented, 72
Mimusops Balata, 148
  globosa, 148
Miro, 250
  toromiro, 250
Monkey Pot, 135, 136
Monocotyledons, xxxvii
Moorgum, 14
Mora, 94
Moraballi, 94
Mora bucquia, 94
  excelsa, 94
  Red, 94
  White, 94
Moreira, 94
Morrell, xv and 128
Morus tinctoria, 202
Mugurpul, 37
Mulberry, Dyer's, 202
Muswal, 29
Myall, 78, 79
  Weeping, 78
Myrsineæ, 147
Myrsine melanophleos, 147
Myrtaceæ, xxxvii and 114–136

Nangka, 205
  buhriet, 205
Nassau, 23
Natal, 3, 4, 26, 43, 47, 45, 49, 53,
  58, 134, 147, 164
Nectandra, Sp., 179, 180, 181
  exaltata, 178
Nectandra, pisi, 177
  Rodier, 176
  Rodioei, 176
  sanguinea, 178
Neem, Maha, 31
Nesodaphne Tawa, 182
New Brunswick, 11, 55, 162, 231,
  234, 266
Newfoundland, 55, 162, 231, 266,
  274
New Providence, 23
  South Wales, 13, 37, 40, 41,
  78, 80, 90, 110, 115, 124,
  125, 132, 183, 185, 189, 214
  Zealand, 7, 8, 15, 42, 76, 111,
  114, 129, 130, 131, 158, 159,
  172, 175, 183, 232, 244, 247,
  248, 249, 250, 251, 252,
  261, 262
Nicarague, Bois de, 68
Niehbuhria, 45
Nieri, 46
Nieshout, 52
Nim, 31
Noisetier, 223
Nongko, 205
Noo Loi, 214
Nova Scotia, 55, 161, 162, 216,
  234, 266, 274, 277
Nut-wood, 223
Nuxia floribunda, 166
Nym, 31

Oak, xii, xiii, xiv, xv, xvi, xviii,
  xxi, xxix, xxx, xxxiv, xxxvi
  African, 6, 195
  American Red, 226
    White, 227
  Baltimore, 227
  Black, 226
  Botany Bay, 214
  Canadian Red, 226
  European, 224
    White, 224
  Forest (Casuarina), 214
  Indian, 170
  Memel, 224
  Mountain, 214
    White, 228
  Oregon, 228
  Riga, 224
  River (Casuarina), 214
  Scrubby, 6
  Silky, 185, 189
  Silvery, 189
  Spanish, 228
  Stettin, 224

Oak, Western, 228
Western White, 227
White, 228
Ochroma Lagopus, 110
Ocotea bullata, 173
Oganwo, 33
Olacineæ, 43
Oldfieldia africana, 195
Oleaceæ, 156–163
Olea Cunninghami, 158
europea, 156
intermedia, 157
lanceolata, 159
undulata, 157
verrucosa, 156
Olive-wood, xii and 156
Olmo blanco, 197
de Corcho, 198
Oomlehbe, 138
Opepe, 240
Orange, China, 21
-wood, 21
(Artocarpus), 205
Oreodaphne bullata, 173
Orham-wood, 199
Orme à grappes, 198
champêtre, 196
parasol, 197
rouge, 196
Ostrya americana, 221
carpinifolia, 222
commun, 222
italica, 222
virginiana, 221
virginica, 221
vulgaris, 221, 222
Outeniqua, 254
Oxandra virgata, 2

Padouk, 75
Padus serotina, 107
Pae Rainha de listras, 203
Pahautea, 260
Paira, 203
Palissander-wood, 62
Palissandre, 62
Panama, 169
Palo de Campeche, 68
Palo Narango, 202
Palo Santo, 19
Pangera falcata, 88
Pao de Campeche, 68
de Rosa, 137
Macaco, 136
Pomba, 27
Paper-bark Tree, 132
Papri, 192
Para, 19, 27
Parenchyma, Woody, xxii
Parinarium, 101
Nonda, 102
Paritium elatum, 9
Parive, 88
Partridge-wood, 91, 93, 97
Black, 91
Brown, 91
Red, 91
Sweet, 91
Paukatea, 260
Pear, 103
Native, 186
Red, 5
White (S. Africa), 43
Pechtanne, 265
Peer, Wit, 43
Pencil-wood, 257
Pernambuco, 203
Persimmon-wood, 140
Peru, 137
Petwoon, 17
Peuplier de Virginie, 238
franc, 236
monilifère, 238
Suisse, 238
Pfefferholz, 36
Pferdefleischholz, 148
Pheasant-wood, 91
Philippines, 70
Phoberos Ecklonii, 5
Mundtii, 5
Photo-micrographs, scale of magnification, vi
Phyllocladus rhomboidalis, 244
trichomanoides, 244
Physocallyma floribundum, 137
floridum, 137
scaberrimum, 137
Picardy, 224
Picea alba, 265
Douglasii, 270
excelsa, 264
grandis, 270
laxa, 265
sitchensis, 266
vulgaris, 264
Picraena excelsa, 28
officinalis, 27
Pigment-zones, xii
Pignon, 277
Pin à mature, 272
blanc, 274
d'Autriche, 272
bon, 277
d'Auvergne, 272

Pin de Bordeaux, 277
  d'Ecosse, 272
  de Genève, 272
  de Hagenau, 272
  de Pierre, 277
  des Landes, 277
  du Lord, 274
  du Nord, 274
  franc, 277
  gigantesque, 278
  Maritime, 277
  Pinier, 277
  sauvage, 272
  sylvestre, 272
Pinaster, 277
Pine, American White, 274, 278
  Apple, 274
  Bastard Black, 250
  Black (Nova Scotia), 277
  Black (N.Z.), 250, 251
  Celery, 244
  Celery-leaved, 244
  Celery-topped, 244
  Cluster, 276
  Columbian, 278
  Douglas, 271
  Dundathi, 262
  Great Sugar, 278
  Italian Stone, 277
  Kauri, 262
  Maritime, 276
  Mountain, 277
  New England, 274
  New Zealand (Kauri), 262
    Red, 217
    White, 249
  North Carolina, 278
  Northern, 272
  Oregon, 270
  Pitch, xxxiv, 275
  Pumpkin, 274, 278
  Red (Canada), 271
  Sapling, 274
  Scotch, 272
  Sea, 275, 276
  Silver (N.Z.), 248
  Soft, 278
  Stone, 277
  Sugar, 278
  Trees, xxi
  Umbrella, 277
  Westland, 248
  Weymouth, 274
  White (American), 274
  White (Nova Scotia), 277
  White-barked, 278
  Wild, 272
Pine, Yellow (P. Strobus), 24
  Yellow (Puget Sound), 271
Pinesse, 265
Pinie, 277
Pinus abies, 264
  alba, 265
  albicaulis, 278
  australis, 275
  canadensis, 264
  Douglasii, 270
  excelsa, 264
  flexilis, 278
  grandis, 270
  Lambertiana, 278
  Menziesii, 266
  Mertensiana, 264
  palustris, 275
  Pattoniana, 264
  pendula, 269
  Pinaster, 276
  Pinea, 277
  sitchensis, 266
  Strobus, 274
  sylvestris, 272
  taxifolia, 270
Piptadenia rigida, 72
Piratinera guianensis, 203
Pirus acerba, 104
Pitch Tree, New Zealand, 262
Pith, xv
Plagianthus betulinus, 7
Plane, xvi, and 207
  American, 207
  Tree, 54
  Eastern, xii and 208
  Maple-leaved, 208
  Western, xv and 207
Plaqueminier de Virginie, 149
Plataan, 207, 208
Platanaceæ, 207, 208
Platane d'Orient, 208
  Faux, 54
Platanus acerifolia, 208
  occidentalis, 207
  orientalis, 208
Podocarpus, African, 254
  dacrydioides, 249
  elongata, 254
  ferruginea, 250
  latifolia, 253
  latifolius, 253
  Meyeriana, 254
  spicata, 251
  Thunbergii, 253
  Totara, 252
Pohutikawa, 131
Poirer blanc, 169

INDEX

Poirier de la Martinique, 169
Pois confiture, 100
  sabre, 88
Polai, 37
Pomba, Pao, 27
Poplar, 1
  American white, 1
  (Barbadoes), 10
  Black, 236
  Carolina, 238
  Necklace, 238
  (U.S.A.), 238
  Virginian, 1
  Yellow, 1
Poppy Tree, 10
Populus canadensis, 238
  deltoidea, 238
  monilifera, 237
  nigra, 236
Pore-ring, xiii, xiv
Pores, xiii, xix
  contents of, xx
  grouping of, xxi
  size of, xiv, xxx, 280
Portia Tree, The, 10
Potlood, 255
Powhiwhi, 7, 8
Practical Hints, xxv
Prince Edward's Isle, 216
Prince-wood, 167
Proteaceæ, xxix, xxxvii and 183–189
Provence, 256
Prunus Cerasus, 106
  emarginata, 109
  salicifolia, 107
  serotina, 107
  virginica, 107
Pseudacacia odorata, 59
Pseudotsuga Douglasii, 270
Pterocarpus angolensis, 69
  dalbergioides, 75
  indicus, 75
  santalinoides, 69
Pteroxylon utile, 52
Purgo, 148
Puriri, 171
Purpleheart, xvi and 84, 86, 87
Purple-wood, 84
Purpuurheart, 84
Pygeum africanum, 102
Pyrus aucuparia, 105
  communis, 103
  malus, 104
  pyraster, 103

Quandong, Brisbane, 14
Quassia, xxvi, xxxii, xxxiv, and 27, 28
  Simaruba, 27
Quebracho, 242, 243
  colorado, 242
Queensland, 13, 37, 40, 41, 78, 80, 90, 110, 115, 124, 185, 189, 214
Queen-wood, 72
Quercus, xxix
  alba, 227
  Garryana, 227
  Jacobi, 227
  Robur var. pedunculata, 224
    sessiliflora, 224
  rubra, 226
  undulata, 228
Quickbeam, 219
Quickenbeam, 219
Quicken Tree, 105
Quick-tree, 219
Quiebrahacha, 242
Quinapole, 100
Quinquina de Cayenne, 28

Rappo tjedo, 205
Raspberry-jam-wood, xvi and 77
Rata, 129, 130
  Northern, 129
  Southern, 130
Rays, compound, xix
  lustre of, xxxvi
  Medullary, xiii, xviii, xix
  Size of, 280
Rebhuhnerholz, 91
Red Bean, 41
Redheart, 42
Red Pear, 5
Redwood (Amazonas), 46
  Andaman, 75
  Giant, 261
  of the Coast, 261
  (Pine), 272
Resin-canals, xxi
Rewa-Rewa, 183
Rhamneæ, 49, 50
Rhamnus celtifolia, 200
  Purshiana, 49
Rhodes, bois de, 168
Rhus lævigata, 58
  lucida, 58
Ribbon-wood, 8
Rimu, 247
Ring-boundaries, xii
Rings, Annual. See Annual Rings.
Rio de Janeiro, 72, 100, 135
  Grande, 37

Robinia fragilis, 59
Pseudacacia, xxxvi, and 59
Roble blanco, 169
Roro, 70
Rosa, Pao de, 137
Rose, bois de, de l'Oceanie, 10
Faux bois de, 10
Rosenholz, Brasilianische, 137
Roses, bois de, 168
Rosewood, xii, xxxv, xxxvi and 63, 66, 67
Bombay, 63
Brazil, 62
Burmese, 75
Dominiça, 168
Honduras, 64, 67
Indian, 63
Madagascar, 63
Native, 10
Nicaragua, 66
(N.S.W.), 40
Red (Baphia), 69
Rosetta, 63
Seychelles, 10
Wanx River, 63, 67
Rothbuche, 231
Rothholz, Americanische, 261
Ostindische, 70
Rothrüster, 196
Rovre, 225
Rowan Tree, 105
Royena lucida, 155
Rubiaceæ, 142–144
Rutaceæ, 21–29

Sabicu, 82, 83
Sabino, 255
Saddle Tree, 1
Saffran-Hout, 47
Saffioran, 47
Saffron, 47
Sahlweide, 235
Saint, bois, 18
Salicaceæ, 235–237
Salichout, 165
Salie-wood, 165
Salix caprea, 235
cinerea, 235
Sallow, Common, 235
Sally, 235
Sambucus nigra, 141
Sandalwood, xxvi and 191
Australian, 190
Sang, bois de, 68
San Paulo, 37
Santalaceæ, 190, 191
Santalholz, Gelbes, 191
Santalholz, Weisse, 191
Santalum album, 191
cygnorum, 190
Sap (Picea), 265
Sapin blanc, 266
du Nord, 265
de Perse, 265
Faux, 264
gentil, 265
Pesse, 264
rouge du Nord, 272
Sapindaceæ, 51–57
Sapota Muelleri, 148
Sapotaceæ, xxi and 148
Sappan-wood, 70
Sappon, bois de, 70
Sapucaia, 136
Sapucaia-nut, 135
Sapucaia-pilao, 135
Sap wood, x, xv
Satin-Walnut, 112
Satin-wood, Bahama, 23
Bermuda, 23
Ceylon, 29
Colombo, 29
(East Indian), 29
Jamaica, 23
St. *Domingo*, 23
Tamil, 29
(West Indian), 23
Saule marceau, 235
Savin, 255
Saxifrageæ, 109–111
Schotendorn, Virginische, 59
Schwartzbuche, 222
Scolopia Ecklonii, 5
Mundtii, 5
Zeyheri, 5
Scrophularineæ, 172
Scrubby Oak, 6
Sebastiao de Arruda, 137
Seefoehre, 276
Sequoia à feuilles d'If, 261
gigantea, 261
sempervirens, 261
taxifolia, 261
Serente, 265
Service Tree, Fowler's, 105
She-Oak, 212, 214
Shingle-wood, 260
Shittim-wood, 49
Siam, 70
Siderodendrum triflorum, 142
Sierra Leone, 6, 38, 195
Silkbark, 48
Silk-cotton tree, xxix
Silky Oak, xxiv, xxix

Silver grain, xiii, xxxvi
Simaruba, 27
amara, 27
officinalis, 27
Simarubeæ, 27, 28
Simarupa, 27
Simiri, 100
Simiridi, 84
Sipiera, 176
Sipiri, 176
Sirouaballi, 180
Siris Tree, 74
Siruaballi, Yellow, 177
Sitjang, 70
Smell of Woods, xxxiv
Snake-wood, 72, 203
Sneezewood, xxvi, xxxiv, xxxvi and 52
Soeren meira, 37
poetie, 37
Soft tissue, xiii, xxii, xxxvii
Solau, 70
Solutions, xxxii
Sommereiche, 225
Sorbier des Oiseaux, 105
Sorbus aucuparia, 105
Sophora tetraptera, 76
Spear-wood, 80
Specific gravity. See Weight
Speckled-wood, 203
Spring-wood, xii
Spruce, xxxiv, xxxvi
Black, 266
Californian Coast, 266
Common, 264
Double, 277
Douglas, 271
Menzies', 266
Norway, 264
Red (Larix), 269
Russian, 264
Silk, 266
Shingle, 266
Tide-land, 266
Western, 266
White (Canada), 265
Stavewood, 27
Stechpalme, 44
Steinlinde, 196
Stenocarpus salignus, 189
Sterculia caribæa, 9
Stieleiche, 225
Stink-wood, 173
Camdeboo, 200
Soft grey, 200
Stinkhout, Kamdeboo, 200
Stone-wood, 221
Straits Settlements, 151
Strawberry Tree, 146
Stringy-bark, Red, 115
Stryphnodendron guianense, 98
Sugar Tree, 55
Sumbawa, 205
Sunda Archipelago, 70
Suradami, xx
Sureau noir, 141
Surface of woods, xxxvi
Surinam, 148
Suriya mara, 73
Sweet-wood, Timber, 178
Swietenia Chloroxylon, 29
Mahagoni, 32, 33, 34
Sycamore, xv and 1, 54

Taaibosch, 58
Tabebuia pentaphylla, 169
Tallicoma, 38
Tallow wood, xxvi
Tamarack, 269
Tamboti, 157
Tanekaha, 244
Tangeao, 175
Tanne, Deutsche, 266
Echte, 266
Edel, 266
Gemeine Roth, 265
Weiss, 266
Tannin, xxxii
Tasmania, 125, 261
Taste of woods, xxxiv
Tatacajuba, 202
Tatajiba, 202
Tatajuba, 202
de tincta, 202
Taua, 182
Tauekaha, 244
Tawa, 182
Tawhai raunui, 232
rauriki, 233
Taxaceæ, 245, 246
Taxus baccata, 245, 246
brevifolia, 246
Lindleyana, 246
Tcheergun, 124
Tea Tree, Paperbarked, 132
Swamp, 132
White, 132
Teak, xx, xxvi, 170
African, 195
New Zealand, 171
Tecoma pentaphylla, 169
Tectona grandis, 170
Terpentinbaum, 267
Tetranthera calicaris, 175

INDEX

Tewart, 121
Thespesia populnea, 10
Thorn, 5
Thuya excelsa, 259
    gigantea, 260
    Menziesii, 260
    plicata, 260
Thyloses, xvii, xx
Tidore, 70
Tigerholz, 203
Tilia americana, 11, 13
    cordata, 13
    europea, 13
    parvifolia, 13
    ulmifolia, 13
Tiliaceæ, 11–16
Timber Sweet-wood, 178
Timor, 205
Tjang, 70
Tjoebadah kampong, 205
Toi, 124
Tooart, 121
Toon, 37
Totara, 252
Towai, 232, 233
Towaranero, 46
Towhai, 111, 233
Traubeneiche, 225
Traubenkirsche, Spate, 108
Trinçomali-wood, 16
Trinidad, 38, 202
Tsuga Douglasii, 270
    Mertensiana, 264
Tuart, 121
Tuggan-tuggan, 185
Tulip Tree, 1, 9, 10
Tulip-wood, 137
    Bahia, 137
Tulipifera Liriodendron, 1
Tunas de Zazas, 82
Turanira, 46
Turnip-wood, 41

Uichi, 92
Uici, 92
Uixi, 92
Ulme, Trauben, 198
Ulmus, sp., 199
    alba, 197
    americana, 197
    campestris, 196
    floridana, 197
    glabra, 196
    mollefolia, 197
    racemosa, 198
    suberosa, 196
Umbomoana, 47
Umbomvana, 47
Umbrella Tree, 10
Umceya, 253
Umguna, 138
Umgwasube, 109
Umiri, 46
Umkaya, 165
Umkoba, 254
Umnoiso, 138
Umtati, 52
Umvanuri, 200
Um-Vumvu, 200
United States, 1, 11, 20, 49, 55, 57, 80, 81, 108, 109, 112, 140, 141, 145, 146, 161, 162, 196, 197, 198, 210, 216, 219, 221, 224, 226, 227, 230, 231, 234, 238, 246, 255, 257, 259, 260, 264, 266, 269, 270, 271, 274, 275, 278
Unkaya, 165
Urticaceæ, xxxvii and 196–205
Uvaria lanceolata, 2

Vancouver, 228
Veilchenholz, 79
Vergne, 217
Vessels, xiii
Verbenaceæ, 170
Victoria, 78, 80, 114, 124, 125, 183
Violettholz, 84
Violet-wood, 78
Vitex littoralis, 171
Vlier, 166
Vouacapoua, 92
    americana, 92
Vouapa-tabaca, 88

Wacapou, 93
Wachholder, Gemeine, 256
    Virginische, 255
Waciba, 101
Wadaduri, 136
Waibaima, 181
Wallaba, 88
Walnut, xv and 209
    American, 209
    Auvergne, 209
    Black, 210
    Circassian, 209
    East Indian, 74
    English, 209
    European, 209
    Italian, 209
    Satin, 112
    Waney Black, 210

INDEX

Wapa, 88
huileux, 88
Patouve, 88
Warra-garria, 185
Washiba, 101
Waterboom, 134
Wattle, Black, of the Nilgiris, 81
Wauja, 37
Weight per cu. ft., xxxiv
Weimuthskiefer, 274
Weinmannia racemosa, 111
rubifolia, 110
Weissbuche, 219
Weissesche, 162
Weisse Ulme, 197
West Indies, 2, 9, 18, 23, 27, 28, 36, 62, 68, 93, 97, 143, 148, 168, 169, 178, 202, 206
Whau Whi, 8
White-top, 124
Whitewood (Brazil), 169
Canadian, 1
Canary, xxv and 1
(Pine), 272
(S. Africa), 45
Wide Bay, 37
Willow, 235
(Australian), 124
Goat, 235
Grey, 235
(U.S.A.), 11
Windward Isles, 169
Wintereiche, 225
Winterlinde, 13
Winter's Bark, xxii
Wit-hout, 45
Wit Peer, 43
Wollpappel, 238
Wong-arrah, 79
Woolia, 37
Woota, 37
Worm-galleries, xxxvi

Xanthoxylon, 23, 24
Xylocarpus carapa, 38
Xylomelum occidentale, 186
pyriforme, 186
salicinum, 186
Xylosma monospora, 3, 4

Yaba, 93
Yariyari, 2
Yarran, 80
Yarrow Tree, 114
Yaya, 2
Yellow-wood, 1
Bahama, 23
Bastard, 254
Common, 254
Indian, 29
Real, 253
South African, 254
Upright, 253
White, 254
Yew, Californian, 246
New Zealand, 252
Oregon, 246
Pacific, 246
Tree, 245
Western, 245

Zagaiholz, 138
Zanthoxylum capense, 24
flavum, 23
Zapatero, 169
Zergipe, 72
Zizyphus Chloroxylon, 50
Zones, Autumn, xi
pigment, xii
Spring, xi
Zuckerkistenholz, 36
Zululand, 47, 53
Zwartbast, 155
Zybast, 48
Zygophyllaceæ, 18–20

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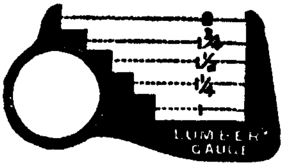

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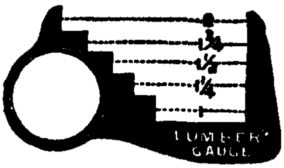

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